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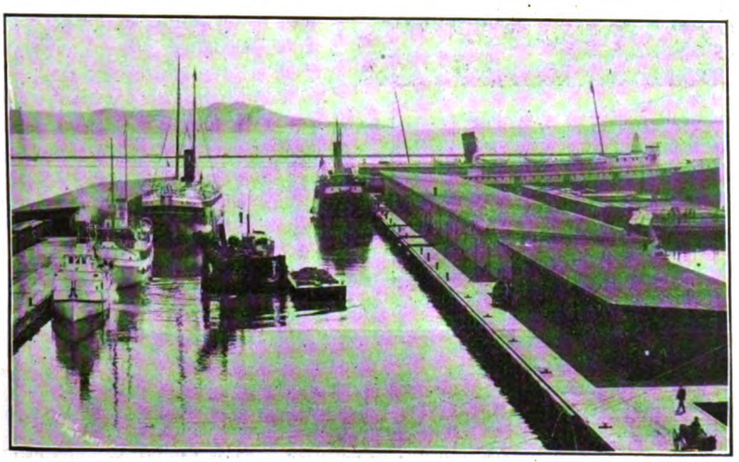
PORT ARTHUR, ONT., AND ITS SHIPPING INTERESTS

The Canadian head of the lakes signifies two growing cities, Port Arthur and Fort William. These two ports, the



VIEW OF DOCKS AT PORT ARTHUR.

one on the side of a hill, the other in the valley under the shadow of a characteristic mountain look out over Thunder bay on a natural harbor of splendid beauty. Nature has, in part at least, mad amends for the bitter winter season by the placement there, of a myriad wooded islands with picturesque shapes, great promontories of bare and rugged rock and rolling hills, that in the summer months seem to wave with moving green and vie in color with the water, clear as crystal and sparkling in the sun. Many visitors have found striking similarities in matters of location, topography and characteristics between these two cities and Duluth and Superior at the American head of the lakes. In this analogy Port Arthur compares with Duluth.

Fort William is essentially the shipping port of the Canadian Pacific Railway whose coal dock and elevators are practically the only shipping mediums. While outstripped at present by its neighbor in handling capacity, due in part to the destruction of a large elevator last winter and the simultaneous building at Port Arthur of the new Canadian Northern Coal dock and elevator, Ft. William can claim the biggest shipping season it has had. It has also a substantial growth represented by the actual building of a large cast iron pipe foundry and the coming erection of a 10,000,000 bu. elevator by the Canadian Pacific Railway the plans for which are now in the hands of the Barnett & Record Co.

Port Arthur exhibits business activity in every direction but three comparatively recent enterprises are especially worthy of description. The blast furnace plant of the Atikokan Iron Co. just blown in, the 7,500,000 bu. elevator built by the Canadian Northern Railroad but now known as the British-American elevator and the new coal dock operated by the Pittsburg Coal Co.

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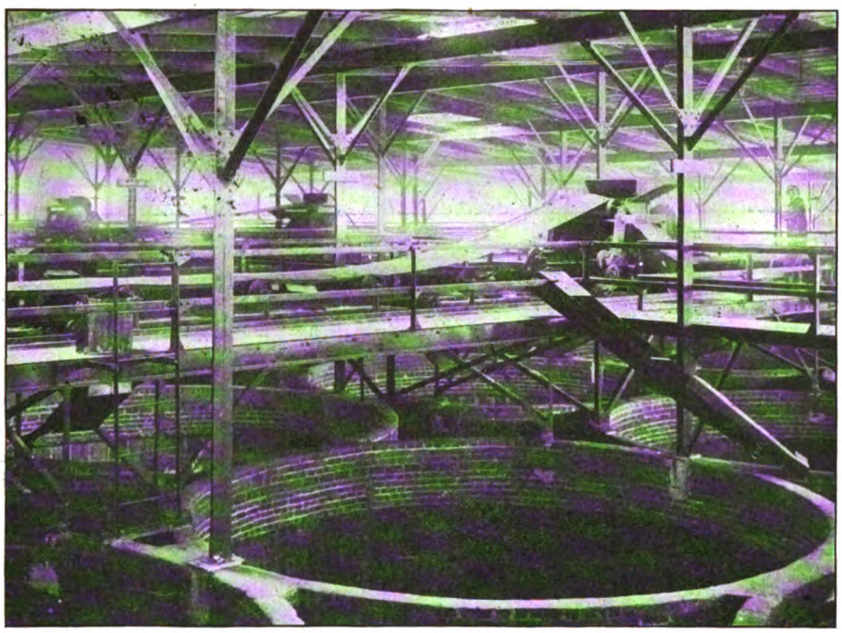
equipped plant having a daily capacity of 150 tons of foundry pig iron. It has been designed to meet the condition of expensive and inefficient labor and as a result the accessories include much automatic equipment. Ore from the company's own mine 80 miles from Port Arthur is being used and though it is a refractory magnetite carrying enough sulphur to necessitate roasting, is being worked with all possible success. At present limestone is being shipped in from Kelley Island but deposits of calcite exist on some of the islands near [illegible] develop a commercial val-

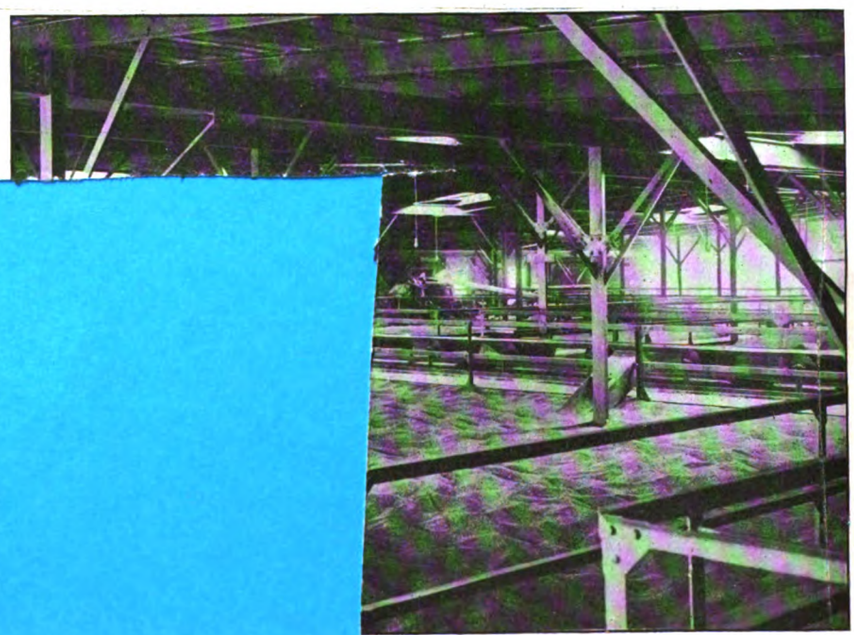
per rig per hour. During the week of July 15-20 the total amount of coal unloaded was 27,890 tons and the actual working time for each of the six days respectively was 13, 14, 13, 13, 14 and 9½; a total of 76½ hours so that an average of 121.8 tons per hour per rig



TANK HOUSE OF BRITISH-AMERICAN ELEVATOR. INTERIOR VIEW SHOWING EMPTY TANKS, CONVEYING BELT AND MACHINE FOR DIVERTING GRAIN INTO TANKS.

of ground. It has storage capacity for a half million tons and a large storage shed for anthracite coal. It is expected that 600,000 tons of coal will have been received at this dock by the close of navigation which is about double the receipts of 1906. Ft. William will handle it is estimated the balance of a million tons.

The British-American elevator is one of the latest types consisting of two work houses and an annex or tank house between. The older house has a capacity of 750,000 bu., the other 1,250,000 bu. and the tank house 5,500,000 bu. giving the entire plant a capacity of 7,500,000 bu. The new portions were built by the Barnett & Record Co. and were completed a little more than two years ago. The two workhouses are equipped similarly with modern cleaning, separating and smutting machinery, the essential difference being in the method of spouting the grain from the scales to the various bins. In the older house separate wooden spouts are used with a hopper from the scale swinging around on a circular track so that the grain may be directed to each spout as occasion requires. In the new house, extension or telescope steel spouts are used. By this method but one spout is required, which by means of its flexible elbows and adjustable length can be swung to any bin from the scale. The new house is of steel construction.



[illegible]RICAN ELEVATOR SHOWING THE TANK HOUSE [illegible]TELY COVERING THE TANKS.

[illegible]eek. [illegible]d for acres

Several views of the interior of the tank house have been obtained showing the nature of the construction, the dis-

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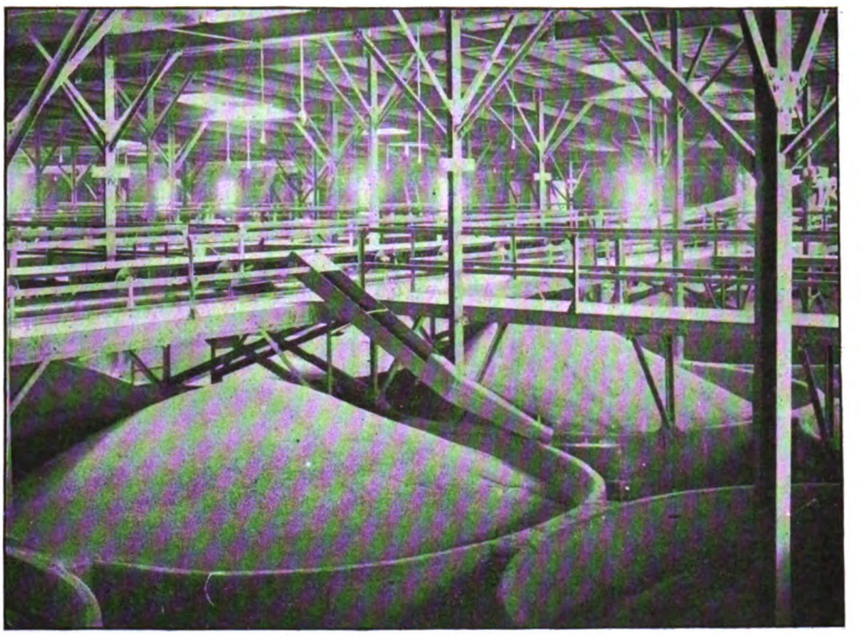
tributing belts and machinery and the bins with the grain in them. The tank house is entirely fireproof without a particle of inflammable building material in it and separated from the other buildings by long galleries. The framework is of steel, the floors of concrete and the bins of tile. The bins are circular in shape, 85 feet deep and each will hold about 30,000 bu. The tile of which the bin walls are built are of the design used in the latest elevators and are of two shapes, a row of ordinary hollow tile alternating with a row of channel shaped tile so placed that in every other row of tile there is a complete annular space available in the wall of the bin in which are laid steel re-enforcing cables that circle the bins and take all the bursting strains.

The grain brought in on railroad cars which are run in to the work houses, is scraped out in to hoppers, directly under the car doors at the boot of elevators of the endless, bucket type, and is raised up to the scales on the top floor. There are six scales in each house three for incoming grain and three for outgoing. When the grain is to be stored it can be spouted from the scales, either before or after cleaning, to one of the conveying belts which carry it over in to the tank house. There it is transferred to the desired bin by a distributing machine through which the belt runs in such a manner that all the grain is diverted through a side spout. This is shown in one of the illustrations.

When the grain is to be loaded out a foot valve discharging onto similar belts at the bottom of the bins is opened and the grain running out is carried to the elevators, up to the scales again and from there out through the loading spouts. Grain has not been cleared out of the elevator as rapidly this year owing to the expectation of a crop shortage and higher prices than could be obtained from scales last winter or spring. There are remaining in the elevator about 4,000,000 bu. The elevator is well situated for boat landing and with two houses can deliver more than one cargo at a time. The other elevator at Port Arthur formerly belonging to the Canadian Pacific railway but now owned privately and known as King's Elevator has a capacity of 300,000 bushels.



THE TANKS AS THEY LOOK WHEN ALMOST FILLED.

Despite the isolation of the port a large amount of contract dredging and towing are handled from Port Arthur, practically all by the associated companies, The Great Lakes Dredge & Dock Co., the Thunder Bay Contracting Co. and the Canadian Towing and Wrecking Co. Ltd. These companies have an equipment of three wrecking barges fitted for sand and gravel loading, six dredges and 12 tugs, including the tug Whalen, the property of the Canadian Towing and Wrecking Co. which made a record for itself as an icebreaker at the opening of navigation. Two of the wrecking barges are shown in the accompanying cuts, the Old Dominion being one of the largest on the Great Lakes. The Empire which has recently been sent over to the Soo will carry 1,100 yards of sand or gravel and her two booms each 70 ft. long with 2 yard clam shell grabs will each lift a load of 12 tons. The two hoists, operating each boom independently were built by the National Iron Co. of Duluth and are 11 x 13 in. with a capacity of 125 H. P. Just now the company is working on the site of the new Canadian Pacific elevator at Fort William.

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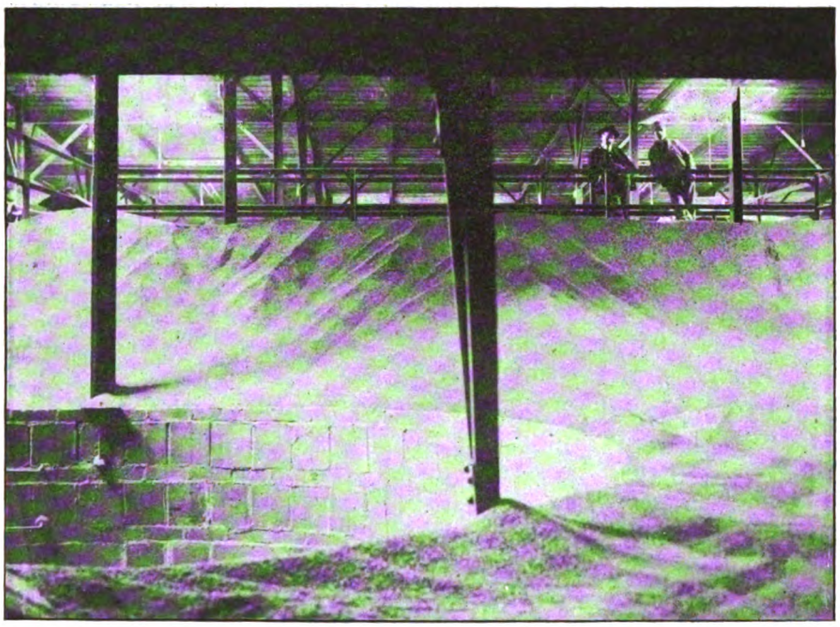
A new breakwater is to be built to be a half mile long and extending from a point a couple of hundred feet east of the west end of the present breakwater making an angle with it over toward Ft. William. The contract has been let to M. J. Hogan of Toronto and work has already been begun.



INTERIOR VIEW AFTER SOME WHEAT HAS BEEN LOADED OUT OF THE TANKS.

MAKING THE PORT OF GARY.

(From the *Engineering Record.*)

The construction of a harbor for the new plant of the United States Steel Corporation at Gary, Ind., is one of the most difficult and extensive of the engineering works required in building that plant. The site of the latter is at the extreme south end of Lake Michigan, 12 miles from the South Chicago plant of the steel corporation, and 26 miles from the central business district of Chicago, where an area of about one square mile, with a frontage of over a mile along the shore of the lake has been provided. This area is covered with fine lake sand to a depth of from 40 to 60 ft. from the surface, which before construction started was formed by a series of alternate ridges and hollows parallel with the shore line. The ridges rose 15 to 40 ft. above the water in the lake, while the general elevation of the depression between them was about 10 ft. above that level. The Calumet river, a sluggish stream that heads in swamps to the east of the site, extends along the rear side of the latter, parallel to the lake, into which it empties at South Chicago, 12 miles away. From South Chicago entirely around the lower end of the lake the shore line is a low, flat and practically unbroken sandy beach. This characteristic shore line existed at the site of the new plant, where the established minimum of 22 ft. in channel construction on the Great Lakes is not reached in the lake until about 2,000 ft. off shore.

General Arrangement of Harbor.—The provision of proper and sufficient harbor and docking facilities for the great number of the largest boats on the Great

[redacted] plant and the terminals of the iron-[redacted] railroads on Lake Superior, was rendered a project of unusual magnitude by these natural conditions. A slip, 250 ft. wide, approximately a mile in length and with a minimum depth of 22 ft. of water, is being built at right angles to the shore line to secure the necessary wharfage and harbor room. This slip extends 2,000 ft. off-shore to the 22-ft. depth in the lake and 3,000 ft. inland. It is being closely lined along both sides with sheet piling to hold the sand in place, and will be dredged to the required depth.

The furnaces and stoves of the steel plant will be in single row along the west side of the slip, at a distance of about 750 ft. from the latter. Large traveling unloading machines will operate the length of the dock on that side and will convey the iron ore from the vessels to storage piles between the slip and the furnaces. These storage piles will be spanned by traveling bridges carrying grab buckets, which will handle the ore to stock piles or to cars for charging the furnaces, the general arrangement being the same as in several existing plants of the steel corporation.

The pier along the west side of the slip from the shore line to the inner end of the slip a distance of 3,000 ft. will have a concrete dock wall carried by heavy pile foundations. This wall extends from 3 ft. below Chicago city datum, the water being on an average about 2 ft. below the lake level at Gary, to 10 ft. above that datum. It is 15 ft. wide at the bottom, has a vertical front face and is stepped on the rear face to a width of 5 ft. at the top. This wall rests on three longitudinal rows of piles spaced 6 ft. apart on centers [redacted] piles

[redacted] The piles in this portion of the pier are [redacted] at least 34 ft. long and are driven to [redacted] at least 30 ft. below Chicago datum. The two outer rows are tied together at intervals of 6 ft. with heavy iron rods; the outer row on the slip side are also

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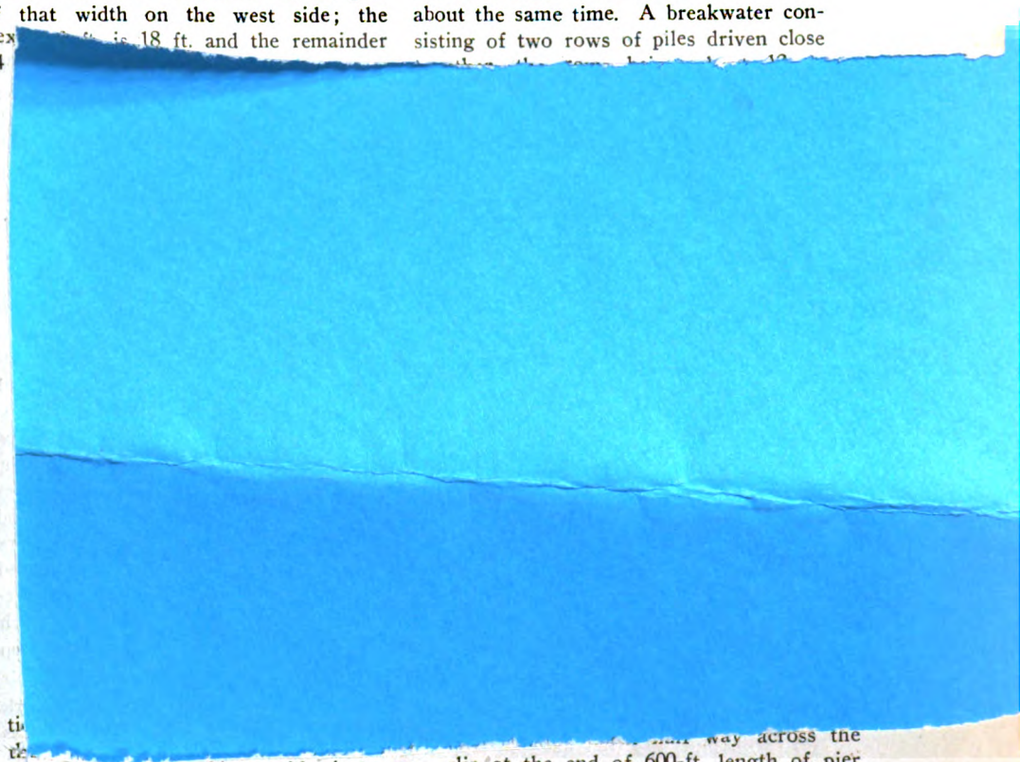
anchored by rods, 44 ft. long, at intervals of 6 ft., to a waling on a fourth row of piles under the footing for the unloader tracks. Immediately inside of the outer row of piles is a row of triple-lap Wakefield sheet piling. This piling consists of 3 x 12-in. Oregon fir in 34-ft. lengths and is driven to a penetration of at least 30 ft. The outer row of round piles are under the toe of the dock wall and are cut off at the level of the bottom of the latter, 3 ft. below the Chicago datum, and are capped with a 12 x 12 in. oak timber. The other two rows of piles and the row of sheet piling are left with their tops protruding as they are driven and are imbedded in the lower part of the concrete wall.

The off-shore 2,000 ft. of the pier along the west side of the slip is a rock-filled timber and pile pier. For the first 600 ft. from the shore line this crib consists of two rows of closely spaced, heavy, round timber piles with a minimum length of 45 ft. The rows are 12 ft. apart on centers and are tied together with two horizontal rows of iron rods attached to oak walings on the piles. A row of triple-lap Wakefield sheet-piling, consisting of 3 x 12-in. Oregon fir planks, 44 ft. long, is driven immediately outside of the row of round piles on the slip side. This sheet piling is protected by a third row of round piles, which are spaced 6 ft. apart on centers; these piles are capped with a 12 x 12-in. oak timber and are tied together near the top with a 12 x 12-in. oak waling piece, which also acts as a fender for the pier. The various rows of piles in the latter are driven to within about 12 ft. of the average water level in this section outside the natural shore line. The space between the two rows of closely driven piles is filled with broken stone from the natural bed of the lake to the top of the pier.

Beyond the 600 ft. of pier 12-ft. in width on this side of the slip, is 700 ft. that is 18 ft. wide and beyond that 700 ft. that is 24 ft. wide. The construction of these wider sections is the same as that of the 12-ft. section. At the outer end of this pier and the west side of the slip a rock-filled timber, and pile pier, 2,000 ft. in length and 24 ft. wide, will be built to the west in the lake at right angles to the slip. This pier will be of the same construction as the off-shore portion of the pier along the west side of the slip, with the exception that the row of triple-lap sheet piling will be omitted in it. The space enclosed by the pier along the west side of the slip and by this outer pier was formerly covered with upwards of 22 ft. of water, but will be filled with sand to a height of 3 to 18 ft. above the water level and on this made ground will be erected a part of the steel plant.

No dockage facilities will be provided along the east side of the slip for the present. From 500 ft. off shore to the inner end of the slip, in a length of 3,500 ft., a row of triple-lap Wakefield sheet-piling, consisting of 3 x 12-in. Oregon fir planks, 44 ft. long, is driven as a lining to retain the sand. This sheeting is protected on the outer side by a row of heavy round piles, driven 6 ft. apart on centers, which are capped on top and are held together by a 12 x 12-in. oak waling piece along the side that also serves as a fender. The second 500 ft. off-shore of the lining on this side of the slip consists of a pier 12 ft. wide and of the same construction as the pier of that width on the west side; the nex[illegible] ft. is 18 ft. and the remainder 24 [illegible]



[illegible] pier, a return pier 24 ft. wide, is to extend 1,000 ft. to the east in the lake at right angles to the slip, and together with the pier along the east side of the latter will enclose an area of made ground, where the lake was originally as much as 22 ft. deep.

Construction of Harbor.—The low, flat beach and the location of the site of the harbor at the south end of the lake, where it is exposed to the full force of the extremely severe northeast storms which sweep the latter, rendered the early construction work on the harbor particularly hazardous. The sand dunes that formed the site of the inshore portion of the slip rose 15 to 30 ft. above the level of the lake and were only sparsely covered with scraggly oak trees and scanty vegetation. The sand in which the slip has to be excavated is extremely fine, clean and free from pockets of gravel or loam. Although not exactly quicksand, it flows so freely when wet that it is confined with difficulty, and in fact, is almost as hard to hold when dry.

Construction on the harbor was commenced in July, 1906, when the contractor for this work, the Great Lakes Dredge & Dock Co. of Chicago, excavated into the site of the slip from the lake with a hydraulic dredge. The piling for a 600-ft. length of the pier on the west side of the slip, extending into the lake from the shore line, were then driven with a land driver running on the finished work. A 500-ft. length of the pier on the east side, also extending into the lake from the shore line was built about the same time. A breakwater consisting of two rows of piles driven close [illegible] way across the slip at the end of 600-ft. length of pier on the west side. It was expected that floating equipment could work readily in the temporary harbor thus formed. The unusually large number of heavy northeast storms which occurred during the past winter and spring however, greatly interfered with the progress of the dredging and pile driving. In fact, at times the floating drivers and the dredge were in much danger from the high surf that prevailed on the flat beach and carried into the temporary harbor without much reduction in force. In order that the floating equipment could be better protected, the breakwater across the slip was extended 40 ft. farther, and a short breakwater built into the slip from the completed portion of the east pier, this second breakwater being far enough toward the shore from the first so an entrance from the lake was provided between the two. With this final

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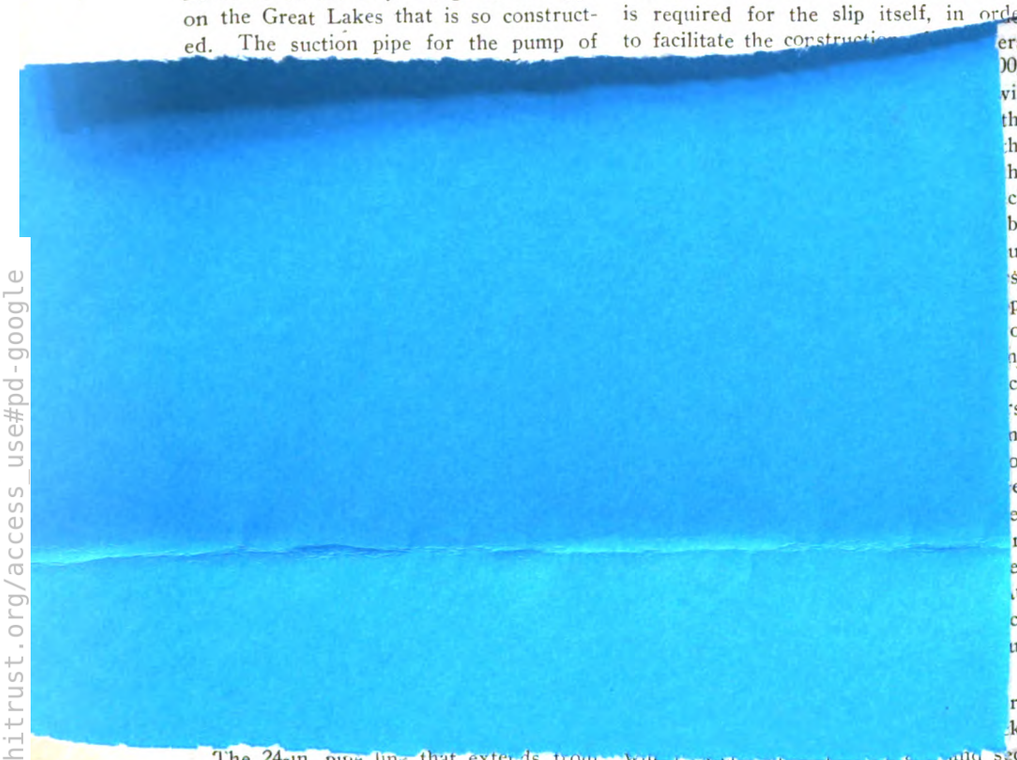
temporary harbor arrangement the floating equipment can work on the off-shore pier construction during good weather and on the piers of the inshore section of the slip when the lake is rough.

After the preliminary dredging had been done with a 15 in. hydraulic dredge and the temporary harbor finished, the hydraulic dredge New York was brought in and is being used to handle the excavation of the slip. This dredge has an all steel hull which has a 40-ft. beam, is 110 ft. long, over-all, and 12-ft. deep. The superstructure is also entirely of steel, so the dredge is practically fireproof, and, as a matter of fact, is believed to be the only dredge of this type on the Great Lakes that is so constructed. The suction pipe for the pump of



The 24-in. pipe line that extends from the dredge to the point where the sand is being deposited for filling is carried on the water by pontoons consisting of hollow 24-in. cylinders built of boiler plates. These cylinders are made watertight and are built in lengths of 10 to 80 ft., depending on their location. They are used in pairs, one on each side of the pipe, the latter being swung from timbers attached to them. The pipe line is provided with flexible joints at intervals in order that bends may be made in the line without difficulty. The sand thus far has been pumped as much as 1,100 ft. from the dredge, the maximum distance to be reached by pumping being about 3,000 ft.

The preliminary plans covering the harbor construction estimated the excavation for the slip to require the removal of approximately 2,000,000 cu. yd. of material. Although under ordinary circumstances the dredge handles 8,000 to 12,000 cu. yd. in 24 hr., when working on the excavation for the inshore section of the slip the roots of the small oak trees interfere to considerable extent with the operation of the pump. Small roots, ½ to 1½ in. in diameter, are found to extend as much as 30 ft. from the surface to reach the water in the thick stratum of sand which makes up the site, fine shoots branching from these tap roots in the vicinity of the water. These fine roots cannot be kept out of the pump, but collect in the latter in considerable quantities and have to be removed.

The excavation for the slip is made somewhat wider at the water level than is required for the slip itself, in order to facilitate the construction

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and section of the slip parallel to and on the east side of the latter. The sheet piling is assembled on this side of the slip; dropped into the water and floated to place. The round piles for the east pier are also floated to place at present from storage piles along the east side. A standard-gage track is laid the length of the west pier as it progresses in order that the piles and stone filling for that pier may be delivered on it. A track is also being laid on the off-shore section of the east pier to facilitate the delivery of material there.

The concrete for the dock wall along the west side of the inshore portion of the slip is made in a mixing plant set up along the site of the wall and adjacent to a service track. A Drake continuous mixer is placed in a tower under storage bins for the concrete materials. The latter have heretofore been handled from cars on the service tracks to the bins in wheel barrows, but arrangements are being made to use a turntable A-frame derrick with a 1½-yd. clam-shell bucket for this service. The mixer discharges into 1-yd. Koppel dump cars, which are pushed to place by hand on narrow-gage tracks laid on top of the wall forms.

Construction of Water Intakes.—The Great Lakes Dredge & Dock Co. also has the contract for building a pair of water intake conduits, each 10 ft. in diameter, which extend from an inlet in the concrete dock wall of the slip to a pumping station in the steel works, 750 ft. from the slip. The inverts of these two conduits are 25 to 26 ft. below the water level, in the sand, and 35 to 50 ft. below the surface, making their construction particularly difficult. The wide and deep excavation in the fine running sand required in building these conduits has been carried forward, successfully, however, by methods specially adapted to the work. The excavation is opened in lengths of 60 to 80 ft., the full width of the trench, a 1½-yd. McMyler clam-shell bucket handled by a turntable A-frame derrick with a 65-ft. boom being used to remove the sand.

The sides of the excavation are lined with close horizontal sheeting as the sand is removed, until the water level is reached. A series of well-point strainers are then jetted down around the sides of the excavation to about the grade of the inverts of the conduits. These well-points range from 1½ in. to 2½ in. in diameter and are attached to pieces of wrought-iron pipe, which are threaded at the top and are screwed into 6-in. or 8-in. pipes laid horizontally around the sides of the excavation. These mains serve as suction pipes for several pumps set up around the excavation. Four to eight pumps are used in drawing water through this drainage system while excavating below the water line is in progress. This arrangement for keeping water out of the excavation has been so successful that the sand inside the limits of the suction mains is kept practically dry as long as desired, and the portion of the excavation below the water line does not require sheeting. The construction of the conduits is also carried on in the dry 25 to 26 ft. below the water level.

The concrete for the conduits, of which about 8 cu. yd. to the linear foot of the latter is required, is made in a Smith mixer set upon a platform on wheels running on a track laid along one side of the top of the excavation. Materials are supplied to the mixer from storage piles along a service track, or from cars on the track, by the clam-shell bucket handled by the turntable A-frame derrick. The mixer discharges into chutes which feed the concrete directly into

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place, the average output being about 120 cu. yd. a day when the outfit is in operation.

The construction of footings for the pumping station in which the two conduits terminate also involved deep excavations in the fine sand. The pumping station building is 45 x 153 ft. in plan. The conduits end in a pump suction chamber, 8.5 ft. wide and 127 ft. long, the bottom of which is 25 ft. below Chicago city datum, or about 26.5 to 27 ft. below the lake level. A 5-ft. layer of concrete was placed in the bottom of this chamber to insure against upward hydrostatic pressure. The pumping station provides room along one side of the top of the suction chamber for seven turbine pumps direct-connected to motors. A heavy base of concrete has been provided for these motor-pump sets, this base being carried down to about 20 ft. below the water level. The side walls of the building are carried by concrete footings 4 ft. thick which surround the suction chamber and pump base.

The wide and deep excavation in the sand for these heavy concrete footings was handled before the well-point pumping outfits had been adopted, heavy close sheeting and a large amount of pumping being required before the work was finished. The concrete was made in the same Smith mixer that is now being used on the conduits, over 6,000 cu. yd. being required.

The Great Lakes Dredge & Dock Co., the contractor for the harbor work and the intake conduits, has the following plant now in operation: The 24-in. hydraulic dredge New York; a land and four floating pile-driver outfits; four derrick scows; several flat scows; two standard-gage turntable locomotive cranes; the A-frame turntable derrick; a light locomotive and train of dump cars; a large tug and various other equipment such as pumps, concrete mixers, air compressors and so forth. At present between 300 and 400 men are employed in the construction of these two portions of the new steel plant. They are housed and fed in model quarters by the contractor, on a cash co-operative basis.

The new steel plant was designed and is being constructed under the direction of G. G. Thorp, vice president of the Indiana Steel Co.; A. B. Neumann is chief engineer, and W. P. Gleason is superintendent of that company. The operations of the Great Lakes Dredge & Dock Co. are directed by T. C. Lutz, vice president and general manager. John R. Williams is superintendent in immediate charge of the work at Gary.

Bids will be opened by the navy department on Sept. 3 for the construction for five torpedo boat destroyers.

SHIPS THAT CAN'T BE HURT.

If there are vessels which, like men, seem born to misfortune, there are also ships which appear to be totally impervious to calamities which would wreck the ordinary craft ten times over. A case in point was the iron steamer Hardacre, which was recently sold for breaking-up purposes on the Clyde.

For thirty years this vessel was continually getting herself into trouble, and although during that time she did an infinite deal of harm to other ships, she herself passed almost unscathed through the most extraordinary experiences. Built in the late seventies, she contrived seriously to imperil the British Channel fleet on her very first voyage.

For some reason, her side lights were out of order and would not burn. In this condition she got in the way of the fleet, consisting of nineteen steel warships, traveling in close formation and at full speed. Any ordinary ship, of course, would have been run down and gone to the bottom.

But not the Hardacre. Instead of going to the bottom herself, she sank one torpedo-boat and caused two others to collide. By the time she was clear of the fleet the damage she had done amounted to a hundred and twenty-five thousand dollars. The Hardacre had her taffrail chipped, but a hundred dollars would have been sufficient to put her in better condition than before the encounter.

Three months later she was towed, unhurt, off Dungeness, where she had been driven in a storm. Once more, on the high seas, the Hardacre was run into by a German bark. The bark was sunk; the Hardacre was unhurt. After this exploit she went aground again, this time near Yarmouth, sank a fishing vessel on the Newfoundland Banks, and finally broke down in the English Channel.

There was a gale blowing at the time, and she was driven on the French coast. The crew was taken off in safety by the life-savers, and the steamer posted as a total wreck. It was not as easy as this to dispose of the Hardacre, however.

She was towed off, and after being patched up was sent on a voyage to the Argentine Republic. Her pilot piled her up on a dangerous reef in bad weather, but that made no difference to the Hardacre. Once more she was refloated, repaired, and then started off, homeward bound.

A cattle-boat ran into the tough old ship, but she refused to sink, and it was not until the Board of Trade declared that she was a hopeless victim of old age that the steamer gave up the fight.

A small steamer called the Diomede enjoys the rather doubtful honor of having been sunk in every one of the five oceans which encircle the globe except the Antarctic. In twelve years she was sunk six times, but it invariably happened to be in water so shallow that it was found possible to raise her.

Even more fortunate was the tramp Vandal, which in the course of seven years managed to figure in ten collisions without sinking until the tenth. There was a sort of poetic justice about this, too, for in only one case out of the ten was the Vandal at fault. Of the ten ships with which she collided, six went to the bottom.

Altogether, it was estimated that the Vandal justified her name by doing—although unwillingly—more than two hundred thousand dollars' worth of damage, in addition to making her unfortunate assailants pay more than thirty thousand dollars for repairs to herself. At the present time she is employed as a store-ship for the Spanish navy.—*The Ocean.*

NEW STEAMER FOR WEST INDIA SERVICE.

The new steamship Guiana arrived in New York this week direct from the shipbuilding yards of Sir James Laing & Sons, Ltd., Sunderland, England. The Guiana was built to the order of the Quebec Steamship Co. for their West India service, and is of the following dimensions: Length, 345 ft.; breadth, 44 ft.; depth, 27 ft. 6 in. The deadweight carrying capacity is 4,800 tons. The steamer is fitted for sixty-two first class passengers and eighty steerage passengers. The Guiana will enter the New York and West India service, sailing on her maiden trip Aug. 31.

When the Panther goes to sea she will be equipped with a complete forge room, a foundry, and a machine shop. The ship has already been christened the "floating navy yard" of the Atlantic fleet. Among the complement of men who will be on board the Panther when she starts for the Pacific will be some of the expert naval mechanics now employed in the Eastern navy yards.

It is reported that Edwin S. Cramp, associated with George W. Norris of the banking firm of Edward B. Smith & Co. of Philadelphia, has purchased a site for a shipbuilding plant at Norfolk, Va.

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LAKE ERIE AND OHIO RIVER SHIP CANAL.

The Lake Erie & Ohio River Ship Caral Co. has received three charters for the construction of a canal from Lake Erie to Pittsburg, one from the state of Pennsylvania, one from Ohio and one from the national government. As the organization of the company is completed and its plans and surveys are so advanced as to be on the eve of actual construction work, it is pertinent to examine the source of its prospective business. The business must, of course, be derived from bulk commodities, in other words, raw materials which from their nature cannot afford to pay a high ton cost and which do not suffer from reasonable slowness of movement.

Of this kind of business certainly an abundance exists in the territory which the canal will traverse and which it will tap. The bulk tonnage of the Great Lakes, which may be said to be subject to movement by canal amounts to 50,000,000 tons per annum. To this would naturally be added the tonnage of the district which the canal traverses and which would largely consist of coal and coke.

Of the 31,000,000 tons of ore which reached Lake Erie ports last year 21,000,000 tons went forward to the Pittsburg district including the Mahoning and Sherango Valleys and the upper and lower portions of the Ohio river. Of the 14,500,000 tons of coal that were shipped on the Great Lakes last year about 9,200,000 tons was the output of the so-called Pittsburg district. It is reasonable to expect that this tonnage will grow rather than diminish, and that by the time the canal would be available for the transportation of a pound of freight it would have a potential field of at least 50,000,000 tons.

There is no doubt that the transportation facilities of the country are inadequate to move the vast volume of business offering. Anything which seeks to increase the transportation facilities must inure to the benefit of the whole people. Eminent authorities quite agree that the business of the country is developing faster than the railways can possibly expand to handle it. It would seem therefore to be economy to relieve the railroad of a class of commodity that it cannot well handle profitably, that is, raw material which is either very bulky or very heavy. It must be said that the projectors of the Lake Erie and Ohio River Ship Canal are projecting their enterprise at an opportune time. By the time it is available to commerce the canalization of the Ohio river from Pittsburg to the Mississippi will be well advanced and the enlargement of the Erie canal will probably be finished, thus providing the Great Lakes with 15,000 miles of navigable waterways, including the St. Lawrence river system.

Presumably if active work is begun on the canal during the next few months it will be completed in 1913. It is estimated that during the first year of operation about 3,000,000 tons would be moved. This is a very reasonable estimate as by that time the coal and ore tonnage available for transportation through the canal will certainly have reached the figure of 52,000,000 tons. It is expected that the canal's proportion of this tonnage will increase rapidly after the first year, reaching 10,000,000 tons in two years and 15,000,000 tons in three years. The projectors predict that in a decade it will be moving 38,000,000 tons of freight. This is, of course, based upon a constantly ascending movement of bulk commodities from the coal mines of Ohio and Pennsylvania and the iron mines of the Lake Superior country, probably 70,000,000 tons by 1922.

Elaborate calculations as to the cost of operation would seem to indicate that ore could be moved from the lake to Pittsburg at 1.73 mills and coal at 1.44 mills. For an average haul of 140 miles this would mean 24 cents for ore and 20 cents for coal. Obviously if these calculations are accurate there will be enormous business offering, as the rail rate from Lake Erie to Pittsburg for ore is $1.14 a ton and on coal 88 cents a ton. The canal could make a rate that multiplied its cost three or four times over and still be well under the rail rate. The present rail rate per ton mile on ore from Lake Erie ports to Pittsburg is 8.93 mills but this includes the cost of unloading at Lake Erie ports, which is 20 cents a ton and also switching and labor to the stock piles at the furnaces. The canal cost per ton mile is estimated at 1.73 mills. It is clear that if these calculations are at all accurate that the railroad cannot possibly compete with the canal in the movement of these bulk commodities. The figures on the rail rates are those of the Bessemer & Lake Erie Railway which is operated between Conneaut and Pittsburg by the United States Steel Corporation.

The financial calculations based upon probable tonnage are that the canal will be able to pay 6 per cent on its capital stock before the fifth year of operation. It is estimated that at the conclusion of the first decade the toll earnings would be over $12,000,000 and the net earnings over $8,000,000. It is assumed that the canal can be put in condition for service in five years at an actual cost of construction, including interest on bonds and taxes, of $53,000,000.

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The canal will have its Lake Erie terminus at Indian Creek somewhat westerly of Ashtabula. The canal utilizes the natural waterways along the route. The first division of the canal is formed by the Beaver river about twenty miles; the second division is formed by the lower portion of the Mahoning river, about thirty miles.

The total rise for these divisions is 177 ft., requiring twelve locks. Beaver river has an average surface width about three times that proposed for the canal. From the head of this stream a branch canal by canalization of the Shenango river is proposed 25 miles long, reaching Newcastle and Sharon. Another proposed, seven miles long, would run from Niles to Warren, Youngstown lying on the Mahoning about ten miles below Niles. The actual canal begins at Niles and pursues a direction due north to Lake Erie. The approach along the Mosquito Creek Valley to the summit will require three locks. It is proposed to construct a lake about nine miles long at the southern end of the summit as the topography is quite favorable to this construction. This lake will form about 30 per cent of the summit length and will serve the purpose of acting as an auxiliary reservoir to the levels below and will provide an excellent place of harborage and will also permit the operation of boats at high speed. The summit is 31 miles long and terminates 13 miles south of Lake Erie. On the descent to the mouth of Indian Creek, Lake Erie, eighteen locks must be provided with a total drop of 327 ft. An equivalent descent is made on the Welland canal between lakes Erie and Ontario with twenty-five locks.

An alternating route diverges at Niles, keeping the river to a point above Warren and reaching the east slope of Grand River Valley by a deep cut, extending this level to a point about seventeen miles south of Lake Erie. The advantage of this route would lie in the fact that it has five less locks. It has the disadvantage, however, of being four miles longer and would cost about $5,000,000 more.

Four methods of transportation are proposed—first by lake steamers of 2,000 tons maximum capacity which would not break bulk between upper lake ports and Pittsburg; second, in steamers of barge type of about 2,000 tons capacity receiving their cargo at Lake Erie ports; third, in boats of canal lake barge type of approximately 2,200 tons capacity in towed fleets from upper lake ports to Pittsburg; fourth, in towed canal barge fleets of about 1,200 tons capacity, receiving cargoes at Lake Erie ports. This fourth method is the one which is regarded by the projectors with greatest favor as it will permit the distribution of single units at the furnaces and the collection of fleets from the coal tipples. Moreover, the new government locks on the Monongahela river are arranged for fleets to be taken through at one lockage, namely one tow boat and three barges of the size proposed by the projectors of the canal. Assuming that the tow boat also carries a cargo, the full capacity of the fleet would be 4,600 tons, based on a maximum draught of 11 ft. It is estimated that the trip from Pittsburg to Duluth can be made in thirteen and a half days. During an average season about sixteen round trips could be made, moving about 54,000 tons. The steamer would cost approximately $105,000 and the barge $60,000.

With the knowledge that the problem of moving bulk freight has become a serious question to the railways, it would appear as though the construction of the large canal would be a sound venture commercially, especially so when the canal pierces the greatest tonnage producing section of the world, and a tonnage, moreover, of a character that would normally seek water transportation.

FREIGHT SITUATION.

There is very little to be said regarding the general freight situation except that dispatch is poor and the outlook not especially encouraging for record shipments. Vessels are delayed at both ends of the route; nor can there be much improvement in this regard during the next ten days. The fact that Labor Day comes on Monday means a double holiday for the docks and vessels that reach port on Saturday are not likely to go out again until the middle of next week. More than usual vexations have marked the conduct of the lake trade during the present year and an unusual amount of freight will have to be moved during the fall months if last year's record is to be broken.

Receipts of coal at Lake Erie ports are light, the railways being short of cars, while the grain trade is practically dead.

IRON SITUATION.

General declines are noted in the pig iron market, following the purchases of odd lots to cover consumers' immediate needs. Southern iron No. 2 has weakened to $18.50 Birmingham for delivery during the remainder of the year. The Jones & Laughlin Steel Co. has purchased 6,000 tons of Bessemer at $22 valley for Sept. shipment. Structural material is very active and contracts are numerous, considerable bridge construction being projected in the country. Rail reservations made by several of the leading trunk lines for 1908 delivery aggregate about 300,000 tons.

MISCELLANEOUS ITEMS.

Capt. C. R. Ney of the steamer Pontiac was presented on August 13 with a sofa pillow and a fountain pen by the members of the crew who had made a mental minute of the fact that it was his birthday.

The wheel chains of the tug Kate White parted off Fairport last week and the tug drifted ashore. The life saving crew took the crew off. The tug was badly pounded.

The excursion steamer Carrington sank in Lake Superior on Aug. 24. Capt. Frechette was taking her from Ashland to Duluth when she began leaking badly. As the water was gaining on the pumps the captain hailed the steamer Frederick R. Wells and put the crew aboard, the Carrington going to the bottom a few minutes later.

The passenger steamer King Edward, bound from Toledo to Sault Ste. Marie, struck a reef in St. Mary's river while running at full speed on Aug. 26. The passengers were taken off the stranded boat by the Frontenac and later the King Edward left for the Ecorse yard of the Great Lakes Engineering Works where she will be repaired.

The steamer Isaac L. Ellwood was sunk in collision with the steamer A. G. Brower on Tuesday night about half a mile below Bar Point. The Ellwood lies in about 20 ft. of water with a hole 3 ft. square amidships. Capt. W. W. Smith, marine superintendent of the Pittsburg Steamship Co., will take charge of the wrecking operations. The Brower is owned by the United States Steel Corporation.

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SUBMARINES GOOD SEA BOATS.

The Naval Board of Inspection and Survey, of which Capt. Sutherland is chairman, has completed its exhaustive trials of the four submarine torpedo boats the Octopus, Viper, Cuttlefish and Tarantula, under contract for the Government, and forwarded its report to the Navy Department. The inspections and trials were held at Newport and including the time spent in the competitive tests by a special board occupied eleven weeks, subjecting the boats to the most exhaustive series of experiments ever made by the department with this type of vessel.

The board devotes much attention to the open ocean trial of the Viper, which was selected to make a ninety-six hour sea test for the purpose of determining the endurance of these boats. The result was a complete refutation of the arguments that boats of this type are suited only for inshore duty. The performance of the Viper demonstrated that she has a radius of action of 1,000 miles without coming into port or communicating with any other vessel for a period of four days.

On her open sea run the Viper was followed by the tug Nina and the tender Sterling, carrying members of the board to observe the movements of the boat, but no assistance was rendered the submarine by either of her escorts. When the Viper left the torpedo station her batteries were charged only partly, and she was put to the test of charging them up to their fullest capacity when running full speed on the surface. This she accomplished successfully.

At a signal from Capt. Sutherland that the enemy's scouts had been sighted the Viper submerged and ran at top speed for six hours at the end of which time she came to the surface and while running under her gasoline engines recharged her batteries. She was kept at full speed during the night and the next morning subjected to a severe test running in the trough of the sea. During the remainder of the long test the boat cruised off Rhode Island.

In view of the fact that the Viper was obliged by the board to be self-sustaining throughout the entire trip, a special chef was taken aboard and meals were prepared upon electric stoves with which the vessel is equipped. Despite the fact that the crew was confined closely in what is practically a steel cage, the men stood the trip well and there were no mishaps. Capt. Sutherland remained aboard the Nina, while Lieut. D. C. Bingham, who is to have command of the Viper as soon as she is commissioned, was aboard her during the voyage, as was also Lieut. E. T. Marquart, who is to command the Cuttlefish.

All four vessels have exceeded their contract requirements and their acceptance is recommended by the board. In the course of their series of trials the four boats cruised at full speed on the surface 1,150 miles, 900 miles in the open sea and including three trips to Cape Cod in heavy weather. Eighty-five submerged runs were made, amounting to 800 miles and 36 torpedoes were fired, all of them successfully with the exception of three.

It has been decided that when the boats are commissioned Lieut. C. E. Courtney shall command the Octopus and Lieut. Joseph F. Daniels the Tarantula.

WORLD'S OCEAN SHIPPING.

The Imperial Statistical office has recently published a compilation showing the amount of ocean shipping of the eleven leading commercial countries of the world. Such a compilation was first made by the Norwegian Statistical Bureau in 1888, and the German figures are published in comparison with those of that bureau. The two publications, therefore, give a fairly correct view of the development of the world's shipping in the seventeen years from 1888 to 1905. The investigations under consideration are based upon the number of vessels arriving at all the seaports of the countries named, hence they have no bearing upon the ownership of the vessels or the amount of cargo carried.

In the following table the arrivals in register tons are given for 1888 and 1905, the former year from the Norwegian and the latter from the German authority, and the percentage of increase is given in the third column:

Arrivals In—	1888.	1905.	Increase, P. ct.
England	37,249,000	48,332,000	30
France	15,450,000	21,887,000	42
United States	13,368,000	30,983,000	132
Spain	11,974,000	15,769,000	32
Germany	9,442,000	19,130,000	103
Russia	7,413,000	11,375,000	53
Italy	7,373,000	12,722,000	73
Netherlands	5,336,000	11,741,000	118
Belgium	4,913,000	11,615,000	136
Portugal	3,630,000	14,043,000	290
Japan	1,486,000	14,373,000	867

It is noteworthy here that the United States made the largest absolute gain. Its arrivals increased by 176,155,000 tons, as against 11,083,000 for England, 6,437,000 for France, 9,688,000 for Germany, 10,440,000 for Portugal and 12,877,000 tons for Japan. The increase for Japan, indeed, is so prodigious as to cast suspicion upon the figures for at least one of the years; most probably the Norwegian statistics were defective for that country. Another remarkable fact brought out in the above comparison is the strong shifting of commerce toward the smaller countries.

The following table shows how the participation of the various countries in the total shipping movement shifted from 1888 to 1905:

	1888. P. Cent.	1905. P. Cent.	Change.
England	28.36	20.85	—7.51
France	11.77	9.44	—2.33
United States	10.18	13.36	+3.18
Spain	9.12	6.80	—2.32
Germany	7.19	8.26	+1.07
Russia	5.64	4.81	—0.73
Italy	5.62	5.50	—0.12
Netherlands	4.06	5.07	+1.01
Belgium	3.74	5.01	+1.27
Portugal	2.74	6.06	+3.32
Japan	1.13	6.20	+5.07
	100	100	

SUBMARINE BELL SIGNALS.

It is announced that the Trinity House Brethren are about to fit submarine bell signals on three of their lightships, the necessary expenditure of £1,200 having been sanctioned by the Board of Trade. The equipment is very simple. A tank connected to the interior of the hull below the water line contains a microphone, from which a wire extends to the wheel house. There a receiver and indicator are hung within easy reach of the navigator. The bell, if connected to a lighthouse, is operated by electricity; if attached to a lightship compressed air or some other mechanical means is used to move the bell.

The latest vessels of the Cunard and White Star Lines are fitted with receiving apparatus for this system. Recently the Mersey Docks and Harbor Board decided to instal the system in the North West Lightship at the bar of the river below Liverpool, and Trinity House experiments have also been carried out with the North Goodwins Lightship.

HENDRICK'S COMMERCIAL REGISTER.

The sixteenth annual edition of Hendrick's Commercial Register of the United States for buyers and sellers has made its appearance. The volume is especially devoted to the interests of architectural, mechanical, engineering, contracting, electrical, railroad, iron, steel, mining, mill, quarrying, exporting and kindred industries. It contains 1,224 pages with an index of over 350,000 names and addresses and upwards of 15,000 business classifications. The work is especially valuable as a buyers' reference and for mailing purposes. It is published annually by the Samuel E. Hendricks Co., 74 Lafayette street, New York, and is furnished at the price of $10 each, express charges prepaid.

The passenger steamer City of Detroit and the lumber barge Harold bound up light in tow of the steamer Ralph, were in collision in the Detroit river across from the Michigan Central freight house last week. The Harold was stove in down to the water line and the stem of the City of Detroit was twisted.

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RECIPROCATING ENGINES FOR OCEAN-GOING STEAMERS.*

BY HENRY DAVEY, M. INST. C. E.

The propelling power of the ship begins with the fuel and ends with the screw. The real fuel economy is the fuel required to drive the ship at a given speed. If the turbine requires a screw which is necessarily less efficient than that of the piston engine, it is the fault of the turbine system. Leaving out the boiler efficiency, the propeller of the ship is the engine and the screw combined. In this connection, what is wanted for the purpose of ascertaining detail loss is not only the actual mechanical efficiency of the turbine, which Mr. Denny is trying to obtain by measuring the torsion of the shaft, but the actual thrust exerted by the screw in propelling the ship. I think an indicator for that purpose might be devised, but it should be an indicator for use with the ship in motion under normal conditions.

The subject of ordinary reciprocating, or, to use a shorter word, piston, engines can better be discussed by comparison with rival systems, such as turbine and gas or oil-engines, although the two latter are not at present used for large ocean-going steamers.

On the question of fuel economy alone I have not been able to obtain any reliable information which would enable me to compare the piston engine with turbine; but it does appear that the turbine has not beaten the piston engine in over-all efficiency—that is, taking engine and screw together.

Economy of fuel must always be one of the most important factors in steamship working, and it may be that the competition of the turbine will lead to improvement in the fuel economy of the piston engine, and possibly in an improved system of working. The turbine will doubtless be improved also.

There is little hope of improved fuel economy from increased boiler pressure alone. The theoretical possibilities of saturated steam at 100 lb., 150 lb., and 200 lb., and at 27.5-in. vacuum, are 8¾ lb., 8 lb., and 7 ½ lb. of steam per indicated horsepower respectively. The best land engines give an efficiency ratio of about 70 per cent., corresponding with 12.5 lb., 11.4 lb. and 10.6 lb. respectively. That is a much better economy than is usually obtained with high-class marine engines.

High-class land engines, owing to the use of the Corliss and drop types of steam-valves, have much less clearance space; they have also a much better steam distribution, and often have reheaters between the cylinders. I do not see why Corliss or drop valves should not be used in marine engines. They might be placed in the covers of the cylinders, and the clearance spaces would in that way be greatly reduced. Reheating between the cylinders might also be adopted on a plan to be named further on.

The introduction of the turbine has given rise to a new arrangement of engines, an arrangement which appears to me to be advantageous for piston engines also—namely, the arrangement of three screw-shafts with a turbine on each shaft, the centre turbine or high pressure one, exhausting into, and supplying the steam for, the two low-pressure turbines working the side, or wing, screws. This arrangement of engines and distribution of steam appears to me to be suitable also for piston engines. Each piston engine would have a separate reversing gear, and the gears would be actuated separately or together as desired. Another arrangement would be that of having a highpressure piston engine for the centre screw, exhausting into low-pressure turbines working the wing screws. It would occupy too much space to go into details, but the scheme is worth consideration, as it would lend itself to a system of superheating the steam between the high and low-pressure engines. In many land engines steam is superheated between the cylinders by means of reheating coils supplied with boiler-pressure steam, but the amount of heat thus added to the steam is not sufficient to effect much saving. What is wanted is an effective superheater for the purpose. It does not appear practicable to supply the heat from the boiler, but a separately-fired super-heater, fired with gas from a gas-producer, does not appear to present the same difficulties. An ordinary gas-producer without gas-cleaning plant would answer the purpose. If a practicable system of what I call stage superheating could be worked out, greatly increased economy would result from its application to both piston and turbine engines.

The piston engine appears to be able to compete favorably at present with the turbine in every respect, except that with the turbine there is not the thud of the piston-engine, there is probably much less vibration, and there appears to be a considerable reduction in the engine-room staff. Also, the cost of upkeep may be less; but only time and extended experience can satisfactorily determine these questions. I do not know that the vibration due to screws alone would be more with the piston-engine and three screws than it is with the turbine and three screws. Probably, as the cost of fuel is so important an item in the total cost, the race between the turbine and the piston engine will be won on the coal bill.

USE OF GAS-ENGINES ON BOARD SHIP.

I am of opinion that there is little hope of the marine gas-engine proving more economical in fuel than the piston or turbine engine. Apart from the question of fuel, the mechanical difficulties connected with the use of large gas-engines for such a purpose are very formidable. If bituminous coal is used, very extensive gas-cleaning plant will be required, a plant quite unsuitable for use in a ship. If the gas is not thoroughly cleansed, tar gets into the engine, and gives rise to troubles which could not be put up with during a voyage. The consumption of coal would probably be about 1¾ lb. per brake horsepower, a result which might be easily beaten by the present or improved piston engines or turbines.

A better use of gas on board ship would be for the purpose of stage steam-superheating for piston or turbine engines. Gas-cleaning plant would not be required in that application. Assuming the piston or turbine engine to be made capable of working with an economy of 10 lb. of steam per indicated horsepower-hour, the result would be much better than that likely to be obtained from the gas-engine, even if the engine could be practically applied and made satisfactory in other respects.

*Paper read at the Engineering Conference of the Institution of Civil Engineers.

COLLIER VESTAL.

The collier Vestal now building at the Brooklyn Navy Yard can be launched within two months, if need be. The keel of the big ship was laid with simple ceremonies the middle of the month of March and work has been progressing steadily on her ever since. The dispatch with which she is now being assembled has never before been equaled in the annals of government shipbuilding, it is said, and Naval Constructor Baxter, under whose supervision the work is being done, is justly proud of the record. The Vestal when completed will be the biggest supply boat and collier in the world. She will displace as much water as do battleships of the second class, being of 12,000 tons displacement.

CONTRACT WORK.

The McClintic Marshall Construction Co. has secured the contract for 13,000 tons of steel for the three New York piers, the general contract for which was placed recently with R. R. & J. H. Staats. Contracts for three additional local piers of the same length, but of less width, are still pending, which will require between 10,000 and 11,000 tons of fabricated steel.

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POSITION FINDING.

BY CLARENCE E. LONG.

FINDING THE SHIP'S PLACE BY BEARINGS.

To find the ship's position when sailing along the land is of the greatest importance in coastwise navigation, and is a subject which the student should give his careful consideration.

THE VALUE OF LAND BEARINGS.

What astronomical observations are to the navigator on the ocean for finding the place the ship is in, are the employment of off-shore distance methods by the navigating officer on the lakes when in sight of land, and the study and use of them to advantage is of the same importance to him that the use of astronomy is to his brother navigator on the high seas; because of the nearness of the dangers which vessels have to contend with in the vicinity of land.

"GIMCRACK" METHODS.

There are any number of gimcrack methods, tables, diagrams and "instruments" for determining the vessel's position, but it is not our purpose in these pages to bewilder the student with cartloads of these methods having no special recommendation only keeping in view that the great point to be achieved now-a-days is to be able to get the required distances accurately, quickly, and without leaving the deck, we will restrict ourselves to an exposition of only bearing methods that we know to be of service.

MUST BE PROVIDED WITH A BEARING INSTRUMENT.

It is pre-supposed that the vessel is provided with an instrument for taking accurate bearings by night as well as by day. Probably the Pelorus is the best all-round instrument for this purpose, as well as for many others, and it has the advantage of being portable, so that if the object of which the bearing is sought should be concealed in one position, the Pelorus can readily be moved to another. It has already been said that there should be a proper stand for the Pelorus on each side of the bridge.

THE 4-POINT BEARING.

Of all methods, that known as "Distance by Four-point Bearing," is probably the most serviceable to the navigator and recommends itself to favor from its extreme simplicity and comparative accuracy. It is as follows: When the light or other fixed object (point of land for instance) bears by compass four points (45°) from the course, note the exact time by watch or clock, and again do so when it bears directly abeam, 8 points or 90° from the course or 4 points from the first bearing. The distance run by the ship in the interval is the distance of the object when abeam; that is to say, the distance that the ship has to run to change the bearing of the object 4 points, is the distance that the object is from the ship. Bear this in mind. It is always so. An example will better explain this:

AN EXAMPLE OF ITS SIMPLICITY.

Let a ship be steering at the rate of 12 miles an hour. At 10 p. m. Twin River Pt. light bears SW (4 points from the course) and at 10:25 the same light bears West (abeam). It has taken the ship 25 minutes to change the bearing of this light four points, and as she is moving through the water at the rate of a mile every five minutes, she has run 5 miles, which, accordingly, is her distance from the light when abeam.

THE MOST CONVENIENT IN PRACTICE.

The 4-point method of ascertaining the distance of the ship from any object is most convenient in practice, as the very trifling calculation required can be performed mentally without leaving the deck, and needs no reference to the chart. In this lies its great charm. All that is necessary is to know the speed of your boat. Every master knows this, or ought to, and he likewise knows just how many minutes and seconds it takes his boat to make a mile or a fraction thereof. If the vessel is towing a log then the distance can be ascertained from it in the following manner: At the instant the object bears 4 points from the course, the observer, by a preconcerted signal, informs an assistant to take the log, that is, to read the number of miles and fractions of a mile that the instrument showed at the time, and a note made of it. At the instant the object has changed its bearing exactly 4 points, as seen through the sight vanes of the Pelorus, the assistant again takes the log, and the difference between the first and second readings in miles and fractions of a mile, is the required distance the ship is from the object when abeam.

NO PLOTTING NECESSARY.

The 4-point method, unlike many other methods, requires no plotting of the bearing line on the chart, in fact, it is not necessary to leave the bridge at all. In this lies its chief merits, for it many times occurs, especially in bad weather, that the navigator has his ship in such close quarters that he does not deem it prudent to leave the bridge for a moment. Take for instance, when it is snowing or when the fog lifts and shuts in again at irregular intervals; in order to get a bearing under these trying circumstances you have got to be "Johnnie on the spot," hence no time can be spared in referring the matter to the chart.

VAR. AND DEV. DO NOT ENTER THE PROBLEM.

Again, in this problem the Deviation of the compass is not considered as the vessel maintains the same course between bearings, consequently, the Deviation is the same for both bearings, and for the reason that it requires no drawing of the bearing lines on the chart, it can be ignored. What is true of Deviation is likewise true of Variation. The compass is merely used for measuring the angles and keeping the boat to a straight line between the bearings.

TO USE THE PELORUS FOR THE BEARINGS.

To use the Pelorus for this purpose clamp its dumb compass dial to its lubber line so that it will be made to read to the same course that the ship is steering by compass then set the sight vanes to the point of the compass exactly four points from the course steered, and clamp it by the large thumb screw on top. As soon as the object comes in range of the sight vanes (as seen through eye and hair piece) note the time by watch, or pilothouse clock, or signal to take the log. A short blast of the whistle will be the proper signal. The ship should be kept very steady on the course when bearings of any kind are being taken. Next set the vanes to the point of the compass four points from the last position, or 8 points from the course, or directly abeam. Observe the same proceedings as before, and when the object appears in line with eye piece as seen through hair piece of bearing attachment, the ship has changed the bearing of the object four points, and the distance the ship was required to run in order to do so, is the distance the ship is from the object when it bore directly abeam. In fact, it is not necessary to clamp the Pelorus to the course steered. Set it to any full point to represent the course steered and the sight vanes 4 points from it. It is merely the horizontal angle that you desire between the course steered and the object, so that the compass, in itself has nothing to do with it, more than to measure the angle that is required.

THE PRINCIPLE OF THE 4-POINT BEARING.

An object to bear 4 points from the course must subtend an angle of 4 points, or 45°, of the compass to the ship's course. All that is necessary is to start from the course, or what you know the course to be, and count to the right or left, as the case might be, 4 points. An object to bear directly abeam must subtend an angle of 8 points of the compass, or 90° to the ship's course; for example, if the ship were steering NNE, an object will bear 4 points from the course at ENE on the starboard side and NNW on the port side, and an object to be directly abeam on the starboard side will bear ESE and on the port side WNW.

The 4-point bearing is the simplest exemplification of the rule that whenever the angle between the course and the object is doubled, the distance run in the interval is the distance off at second bearing.

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A HINT AT GEOMETRY.

Mathematicians tell us in geometry that equal angles of a triangle give equal sides in the same triangle, that is to say, the two sides of the triangle opposite the two equal angles are similar. To prove this, take the protractor and lay down a triangle having two of its angles the same, connect the two sides by drawing the third side, and then measure with the dividers one of the sides opposite one of the equal angles; having done this, with the same measurement between the points of the dividers, measure the side opposite the other equal angle and it will be found precisely the same. You can do the same thing on the chart by laying off by means of the parallel ruler and compass diagram, the various lines and angles required, and you will find them just the same. If it be desired to work this to a large scale it will be found convenient to lay these bearings down, using as a starting point, any convenient intersecting parallel and meridian on the chart. Make your plan to any scale you wish. To prove this again, take the foregoing example of Twin River Pt. Take the parallel rulers and lay them over the center of the nearest compass rose in that vicinity, with its beveled edge over the light as indicated on the chart, and draw a pencil line to show the bearing SW and prolong it several inches; then with the parallel ruler over east and west, work the paraller ruler to and over the same light, and draw another pencil line to represent the bearing west, making it of the same length as the other. We now have the two bearing lines traced on the chart, one 4 points from the course, and the other 8 points from the course. Now, with the parallel ruler set to the course (on north and south of compass diagram) transfer this line to the other two bearing lines already drawn, and from near their extremities draw this north and south line (representing the course south) connecting those lines, and forming the third side of the bearing triangle. Preserving this same line, move the parallel ruler from you about a quarter of an inch from the first line and draw a line parallel to it, and continue to draw as many as you like, and when completed it would have the appearance of Fig. 2. Take your dividers and with one leg at the point where the line north and south intersects with the line east and west, place the other leg at the point where this north and south line is intersected with the SW and NE (as SA in Fig. 2). Now with one leg of the dividers still at the intersecting point of the north and south line with the east and west line (at A) place the other leg (with the same span between the points of the dividers) at light (L) and it will be found precisely the same distance. Measure the other lines in the same manner, and each will be found equal to the other. They must be equal, for Euclid says that equal angles subtend equal sides (equal sides subtend equal angles). The triangle forming the sides of the 4-point bearing is what mathematicians term a right-angled isoceles triangle.

THE ISOCELES TRIANGLE.

An isoceles triangle is a triangle having two of its sides equal, no matter what the angles may be, but a right-angled isoceles triangle is one that contains a right angle (90°). As the sum of the three angles of every triangle is equal to 180° two of the angles of this right-angle isoceles triangle (the 4-point bearing) must equal 45° each, and with the right angle (90°) makes the sum 180°, and so they do.

GET THE CORRECT IDEA OF IT.

Do not imagine from this that every right-angled triangle can be worked as a 4-point bearing. We can have right-angled triangles with unequal sides, but not so with the right-angled isoceles triangle, for the two sides that are equal will subtend the same angle, and as one of these angles is given as 90°, the other two must equal 90°, in order to make the sum 180°, and as the sides are equal the angles are likewise equal, and to have the two angles equal they must be one-half of the right angle, or 45° each.

HOW SURVEYORS USE THE 4-POINT BEARING.

Surveyors have recourse to this 4-point method in determining the distance across a body of water where other methods are impracticable. For example, supposing that you were on one bank of a stream and you desired to know the distance across the stream to the other bank. You select a suitable object for the bearing, say a tree on the shore line of the opposite bank, the bearing of which from your position is W by N. You set your bearing attachment at right angles to this bearing, which will be N by E (90°, the right angle of the isoceles triangle). You sight through the vanes and in the distance another tree, or a rock, hill, house, or other object, that is in a direct line or range with your sight vanes. If there is no object in line have an assistant erect a pole instead. Now walk directly for it (in a straight line) measuring the distance as you proceed, until you get the angle of the tree on the opposite bank to bear 4 points, 45°, or SW by W from you; or you walk until you change the bearing 4 points. The distance thus traversed is the distance from your first position across the stream to the tree, or the distance across the stream. The angle from your second position to the tree is 45° and from the tree to the first position is also 45°. This is practically the precise manner in which it is utilized on board ship. The only difference is that on land you have to find the course (N by E in the above case is the course) after the first bearing is taken, while on board ship, the bearings are made to correspond to the course, and not the course to the bearings as just shown.

WHAT SAILORS CALL IT.

This bearing is known among sailors as the "bow and beam bearing," deriving its name from the relative directions as described from the vessel herself by those on board, or the manner in which it is taken "broad off the bow" and "directly abeam."

MUST KNOW THE SPEED OF YOUR BOAT.

You must know how fast your boat is running per hour. First figure out for the boat you are in how long it takes her to make a mile, and then all you have to do is to divide the time between bearings by the time it takes to make a mile.

AN EXAMPLE WILL EXPLAIN IT.

For example, let a vessel be steering NNE at a speed of 11 miles an hour. At 9 a. m. a lighthouse is observed to bear ENE and at 9:23 the same lighthouse bears ESE, or abeam, or 8 points from the course, or 4 points from the first bearing. The vessel is off the lighthouse the same distance she ran to change the bearing 4 points. At 11 miles an hour it takes 5.4 minutes to make a mile and 23 minutes divided by 5.4 minutes equals 4.2, the number of miles run between bearings, or the distance off when abreast.

BY SIMPLE PROPORTION.

The distance may be found by simple proportion: thus, the ship makes 11 miles in one hour or 60 minutes, hence we get this proportion: as 60 minutes is to 23 minutes so is 11 miles to x miles, the unknown quantity, or thus:

As 60 minutes is to 23 minutes so is 11 miles to x, and x equals 4.2 miles, distance the vessel runs in 23 minutes at the rate of 11 miles an hour.

```
   11 (3d term).
 × 23 (2d term).
 ---
   33
  22
 ---
60)253.0(4.2, the 4th term, or ×
  240
 ---
  130
  120
 ---
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The barge Manila which was in collision with the steamer H. W. Oliver is being repaired at Toledo. The Oliver was repaired at Buffalo.

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DREDGING AND CONSTRUCTION WORK.

The bidders for dredging in the Potomac and Anacostia rivers near Washington were the Atlantic Gulf & Pacific Co., New York, at $174,440; the Bowers Hydraulic Dredging Co., Camden, N. J., $170,450; Charles Vivian & Co., Islip, N. Y., $191,220; the Cataract Dredging Co., Baltimore, Md., $194,320; the American Dredging Co., Philadelphia, $199,885; the Coastwise Dredging Co., Norfolk, Va., $194,530; and the Maryland Dredging Co., Baltimore, $170,040.

Fergusson & Ward, Key West, Fla., were the only bidders for the breakwater wall at the United States naval hospital, Key West, their bid being $7,992.

Bids were recently opened by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for filling in back of the Quay wall at the Portsmouth navy yard. Lesher & Wagner, 114 Pavonia avenue, Jersey City., N. J., bid $40,940, and the Boston & New York Contracting Co., 220 Devonshire street, Boston, bid $37,844.

The contract for removing the ledge at the Portsmouth navy yard has been awarded to Johnson & Verden, of Lewes, Del., at $119,900.

Major Charles L. Potter, government engineer, Tompkinsville, N. Y., recently opened bids for dredging in San Juan harbor, Porto Rico. Bids were submitted by the Utrecht Contracting Co., 326 53rd street, Brooklyn, N. Y., at $252,133; the Standard Dredging Co., Wilmington, Del., at $803,960; Michael J. Dady, 350 Fulton street, New York, at $1,455,545.

DREDGING IN DELAWARE RIVER.

The work of dredging the 30 ft. channel in the Delaware river between Christian street and the state line at Marcus Hook, the city of Philadelphia's share in the digging of the deep channel to the sea, is progressing so rapidly that Chief Webster, of the bureau of surveys, is of the opinion that the channel can be completed by next June, the time limit set in the contracts. In order that the general public may be informed of the progress of the undertaking to date the chief has had prepared a map of the river showing just what sections of the channel have been dregded and what sections of rock or mud remain to be removed.

In order to expedite the work the federal government, which has undertaken to dig several sections of the channel, has put to work its immense suction dredge Delaware. The contracts for other sections were let to the American Dredging Co., which at this time has on the work six dredges, many of them of large capacity. Two other dredges, the Baltimore and Baltic, were recently taken off the job because of objections to their construction. The dredges at work are daily removing hundreds of cubic yards of the river's bottom, and Chief Webster's map brings the progress made forcibly before all familiar with the obstructions which had to be overcome to reach its present stage of completion.

The money for the undertaking, which will cost $750,000, was appropriated jointly by the city and state, and the payments made to date to the government and to the dredging company total $324,588.47. The city's contract with the dredging company is $430,400, of which $213,050.23 has

Dredging in Boston Harbor.

Abstract of Proposals for Dredging under Continuing Contract, Divisions 5, 6, 7 and 8 of 35-foot channel, Boston Harbor, Mass., received in response to attached advertisement dated May 29, 1907, and opened June 29, 1907, by Maj. Edw. Burr, Corps of Engineers, at U. S. Engineer Office, Boston, Mass.

No.	Name of Bidder	Division 5				Division 6				Division 7				Division 8				Divisions 5, 6, 7 & 8 Consolidated				Remarks
		Sec. 5		Sec. 5a		Sec. 6		Sec. 6a		Sec. 7		Sec. 7a		Sec. 8		Sec. 8a		Sections 5, 6, 7 & 8		Sections 5a, 6a, 7a, 8a		
		Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	Dredging	Bowlders 6 tons or more	
		Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	
1	G. H. Breymann & Bros. Toledo, Ohio.*																	22	12	40	24	Lowest Bid
2	Morris & Cummings Dred. Co. New York.	$25\frac{9}{10}$	10	$48\frac{9}{10}$	10																	
3	Maritime Dredging Co. New York.									$26\frac{75}{100}$	$19\frac{95}{100}$	67	23	$27\frac{75}{100}$	21	67	23					No evidence filed of signer's authority to bind Company
4	Daly & Hannan Dred. Co. Ogdensburg, N. Y.	27	8	51	15	$23\frac{9}{10}$	8	44	15	28	8	52	15	28	8	52	15					
5	Eastern Dredging Co. Boston, Mass.	$28\frac{3}{10}$	3	$48\frac{3}{10}$	8	$27\frac{3}{10}$	3	$48\frac{3}{10}$	8	$26\frac{3}{10}$	3	$53\frac{3}{10}$	8	26	3	$53\frac{3}{10}$	8					No evidence filed of signer's authority to bind Company

*Awarded.

Estimated Quantities:
Secs. 5, 6, 7, 8—10,025,000 cu. yds.
Secs. 5a, 6a, 7a, 8a—2,536,000 cu. yds.

Estimated Cost: Sections 5, 6, 7, 8—20 cents per cu. yd.
Sections 5a, 6a, 7a, 8a—40 cents per cu. yd.

$500,000 available and $3,894,000 additional authorized, Act of Mar. 2, 1907 for improving harbor at Boston, Mass., of which $3,096,000 is allotted for dredging and $1,298,000 for ledge removal ($\frac{357,000}{400}$); also available $40,000 of Act of Mar. 2, 1907, for improving Mystic and Malden rivers ($\frac{7557}{457}$).

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already been paid out, while the government has received $111,538.24.

That section of the channel in the river between Marcus Hook and Eddystone is complete with the exception of about 230,000 cubic yards of material which remains to be removed from off Schooner Ledge Bar. This section is being dredged by the American company, which so far has removed from the river's bottom 1,525,358 cubic yards of material. A great deal of dredging yet remains to be done on Tinicum bar, opposite Tinicum Island. The government engineers are doing the work from Eddystone to the Horse Shoe Curve, there being sections uncompleted off Fort Mifflin and near the mouth of the Schuylkill river, where the shoaling in recent years has been very bad.

The government employes last year dredged 638,746 cubic yards of material, and this year so far has dredged 258,717 cubic yards. A part of the American Dredging Co.'s contract is the dredging from League Island to Christian street. Out of the 846,000 cubic yards to be removed from that section the company has so far removed but 32,439. The entire amount of dredging to be done in the whole work, which is divided into four sections, is as follows: Section 6, 896,000 cubic yards; 9, 846,000 cubic yards; 7, 850,000 cubic yards, and section 8, 1,222,000 cubic yards.

DREDGING AT ONTONAGON.

The United States Lake Survey is informed by Maj. Graham D. Fitch, United States engineer at Duluth, that an examination on Aug. 12-14 of the recently completed dredging at Ontonagon, Lake Superior, shows a channel 13 ft. or more in depth at low water, 120 ft. wide between the piers, but only 75 ft. wide for this depth at a point in the lake 300 ft. outside the piers. However, there is not less than 12 ft. of water anywhere outside the piers. Vessels will find the best water on a line 90 or 100 ft. eastward of the line of west pier, or 25 to 35 ft. west of midchannel, on which line there is not less than 14½ ft. at low water (about 1 ft. more at present stage).

In the inner harbor, channels 70 ft. wide and 13 ft. deep lead to the Commercial dock on east side and for 200 ft. along its front, and to the lumber dock on west side and along its front up to the west draw opening of the highway bridge. These government channels pass 30 ft. away from the docks, but private dredging provides good water close in along the dock fronts. The middle ground between the two channels is only 4 to 7 ft. deep. The turn for either dock should be made when at a point between the piers about 300 ft. north of their inner or south ends.

DEEPENING OF DULUTH CANAL APPROACH.

The United States Lake Survey announces that the deepening of the lake approach to the Duluth Canal, under direction of Maj. Graham D. Fitch, was completed Aug. 17. This work provides fully 30 ft. of water for the entire 300 ft. width on prolongation of channel between the canal piers, and an additional width of 30 ft. to southward of line of south pier.

The depth on the lake approach was formerly about 25 ft. and no dangerous shoaling has ever occurred, but the deepening to 30 ft. was undertaken by the government owing to complaints that two vessels struck bottom while entering during the severe storm of November, 1905.

PASSING BAR POINT DREDGES.

Col. Charles E. L. B. Davis, government engineer, has issued the following notice:

The dredging contractors at Bar Point, Detroit river, complain about the speed of passing boats, which endangers their plant and interferes with its operations. Vessels also pass entirely too close to the dredging plant, on both sides of which there is ample room with safe depth of water. Vessel masters are therefore cautioned not to approach the dredging plant too closely, and also to pass it at a moderate speed so that the swells will not hamper the dredging operations. It is hoped that this notice will be sufficient, and that it will not be necessary to invoke the aid of the law, which protects plant engaged in the improvement of navigable waters, attaching a penalty of fine and imprisonment for violation thereof.

NAVIGATING AMBROSE CHANNEL.

Steamship people at this port are awaiting with no little interest the arrival of the Lusitania—the Cunard Line's new 25-knot turbine flyer. Its arrival will mark a new milestone in the commercial facilities of the port; not so much as a result of the size and speed of the boat as on account of the opening of the new Ambrose Channel, which will be formal notice that the port of New York is prepared to receive all modern steamers regardless of their size and regardless of the depth of water they draw.

The new channel, when completed, will be 2,000 ft. wide and 40 ft. deep at low water. It has now been completed to the extent of an irregular width of about 800 ft. and a depth of 32 ft. at low water. The old Gedney Channel has a depth of but 30 ft. at low water, and the White Star Liner Baltic, drawing 32 ft., scraped bottom a few months ago when leaving the port. The Lusitania will draw about 30 ft., possibly less, as she will have used up her working coal supply. No trouble is anticipated in bringing the vessel in, owing to the small amount of coal on hand. But the greatest fear is that with a full complement of coal on board there may be some slight obstruction in the channel that the careful and comprehensive soundings that have been made may not have discovered. The army engineers, however, are confident that no such formation exists and that any obstructions that might possibly be encountered will be harmless.

A party consisting of prominent steamship and government representatives and pilots passed through the channel last week on a trip of inspection. They found that, with the exception of its mooring buoys where the contractors have been removing located obstructions, the course is quite clear, and it was therefore decided that it would be safe to use the new channel for the Lusitania. The steamer will leave Queenstown on Sunday, Sept. 8, immediately after the arrival of the London mail, and is expected to reach the lightship about sunrise on Friday. It will be high water at the Hook about 11 o'clock and the Lusitania will probably start up the channel about 9 A. M., so as to come in on a rising tide and have plenty of leeway in case of accident. As has already been noted, however, the same anxiety is not felt for the incoming trip as for the outgoing one. It is suggested that it may not be considered wise to give the vessel her full coal supply—sufficient, for instance, to send her across at her highest speed—because of the possible uncertainty of the channel's depth. The government engineering department is, however, quite confident that the course is perfectly and uniformly clear. Every yard has been sounded, and the only chance of any part not being covered is some small

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obstruction between the rows of sounding lines.

The use of the part of the Ambrose Channel that has already been completed will be restricted to vessels of deep draught, in order that the work of completing the entire channel may not be interfered with unnecessarily.

The new channel is about seven miles long. It begins about one and one-fourth miles southwest of Coney Island and extends in a generally southeastern direction, ending about a half a mile north of the Gedney Channel in deep water. In the part already completed it has 45 ft. depth on its ocean entrance and comes up one and one-half miles on the southerly side of the proposed 2,000 foot-wide channel; it then crosses over gradually to the northerly side. The present available depth is 33 ft. at low water, comparing with 30 ft. in the old Gedney. The deepest draught vessels that have thus far attempted the channel are the government dredges, which draw 23 ft.

The Cunard people would prefer not to bring up a vessel of the Lusitania's size—almost 800 ft.—around the elbow in the Gedney Channel. This is the reason that Mr. Vernon H. Brown, American manager of the Cunard Line, has been pushing the war department to have the new channel sufficiently completed for use before the big vessel arrives.

The mean draught of the steamer on her trial trip was 32.9 ft.

A GOOD THING.

This is what masters, mates, managers and owners are saying about the MARINE REVIEW Course Finder. In every direction the work has been endorsed and we have yet to hear of a case where it has been unfavorably received or mentioned. The Course Finder must not be compared with a book of sailing directions, which contains all the information in regard to harbors, such as the direction of the piers, lighthouses, bearings, etc. The government furnishes all such books as these either gratis or at a very nominal cost, but none of these works can render the service performed by the Course Finder. All of the courses and bearings contained in the Course Finder are based on the true courses and bearings of the latest lake charts; they have been corrected for variation, and the correct variation has been allowed for along all such routes. But the great service accomplished by the Course Finder is in finding the actual course to be steered by any compass and for any boat and on any route. It applies the correct deviation to any course in a mechanical way and it does it accurately. It is the finding of the compass course (allowing the variation and deviation) to be steered that is of real value to every master, and this is just what the Course Finder is for. It will not only find your course in the first instance, but it will check or verify it if you have determined it in some other way.

The Course Finder will make the masters' and mates' work easier and surer, and there is no other work which can think of taking its place. It supplies a long felt want. It is a safeguard to every ship, as much so as the emergency steering gear, submarine signals, speed and depth records, etc. It is as important to the equipment of a ship as the compass, charts, barometer, etc., and it is the opinion of the majority of masters that owners should supply their boats with them for protection against stranding, and running unnecessary distances on account of steering wrong courses.

In conjunction with the Course Finder there is a Deviation Log Book, which gives all the River ranges telling just how the compass should read if it were correct, when heading on any one of these particular ranges. There are blank columns after each range for recording the reading of the compass when on with the range. This Dev. Log Book contains the river ranges just as you run them. There are four sets of them, two for up bound and two for downbound. This is all the data necesary in using the Course Finder.

An auxiliary to this is a Deviation Diagram. This diagram represents the compass straightened out instead of circular so that each point and fractional point is a straight horizontal line instead of a radial line as on the compass. Then each river range that conforms to a certain compass point is printed on the same line; hence, all that is necessary is to run the rivers and lay off the deviations on these lines and draw a curve through them. This curve is the same thing as a full table of deviation for your compass, and it gives you the deviation of the compass on those points for which there are no ranges. Any master equipped with these safety methods of navigation lessens the chances of going wrong a hundred-fold. It is as much, if not more, to the owners' interests than the captains' to be supplied with these devices. The MARINE REVIEW feels confident that if masters and owners will look into this work they will find it to their interests in equipping their boats with them. The cost of the outfit is trifle compared with its usefulness. An outfit could be the means of saving thousands of dollars worth of drydock bills to say nothing of the loss of time in the event of an accident.

Every bit of this work is not only thoroughly explained theoretically but also practically and it is explained in a way that can be understood by any master or mate. Every example deals with practical lake problems. In other words, every master has the opportunity of verifying the work in going over the actual ground. He can prove everything in making the trip up or down the lakes. What can be more satisfactory than this?

Following are a couple more of the numerous courses taken from Course Finder: Buffalo to Cleveland: Buffalo to Fairport, starboard ½-point from the course shown by compass with Buffalo N. breakwater light in range with Waverly Shoal gas buoy. Fairport to Cleveland, same course as shown by compass when in range with Buffalo breakwater south entrance light and Seneca Shoal gas buoy.

Whitefish Pt. to Passage Island (straight course) same course as shown by compass with St. Mary's river upper range over stern.

Sandusky to Fairport, port ½-pt. from the course shown when in range with Sandusky pierhead light and rear light of Inner Range.

QUESTIONS FOR MASTERS AND MATES.—NO. 40.

561. The compass course is E ½ S, wind S by E, leeway 1¼-pts., Var. 42° Ely, and Dev. 15° Wly, what is the true course?

562. What is civil time?

563. When does the civil day begin?

564. What is astronomical time?

565. When does the astronomical day begin?

566. How would you convert 43° 15′ 40″ into time?

567. Convert 5h. 43m. into arc.

568. How do you convert time into longitude of arc?

569. What is an azimuth attachment?

570. What is a chart compass?

QUESTIONS FOR WHEELSMEN AND WATCHMEN.

FOURTEENTH INSTALLMENT.

155. If you were approaching a sailing vessel on a dark night from any direction more than two points abaft the schooner's beam, how would you know it?

156. If you are steering SW and are astern of another fellow who is steering south, what lights can you see on him?

157. You are heading south and another fellow on your starboard beam is steering SE, which of you have the right of way?

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158. Under the same conditions you give the fellow two blasts of your whistle and he answers with two blasts, which of you would go astern of the other?

159. If you were heading NE over what points of the compass would your green light show?

160. On which side is the green light to be carried?

161. What lights on a steamer with a tow would you observe if you were overtaking the tow?

162. How would you know that it was a tow?

163. How would one sailing vessel know in the night time when she was overtaking another sailing vessel?

164. With the wind west and you steering SW you hear a sailing vessel on your starboard bow blowing one blast of her fog horn, which way would you put your helm to go clear?

165. A vessel closehauled on the starboard tack heads SW x W and NNW on the port tack, what is the direction of the wind?

166. A sailing vessel closehauled can lay within five points of the wind; with the wind north what courses could she make with the wind striking her free?

ANSWERS TO QUESTIONS FOR WHEELSMEN AND WATCHMEN.

ELEVENTH INSTALLMENT. PUBLISHED AUG. 8.

119. You will run into each other. Hold your course. The other fellow blows one blast and ports his helm. You answer with one but keep your course.

120. You must keep out of the other fellow's way. Blow one blast and port your helm. You must keep out of his way even if it is necessary to stop and back; or even to go round on a hard-a-starboard helm.

121. He would cross my course astern.

122. He would pass ahead of me.

123. Know that either sidelight shows 10 points of the compass over the horizon, hence, if I reverse the compass bearing of the light from me and count about 5 points to the right or to the left of it, depending whether it be the red or the green light, will give me the approximate direction that such ship is heading. The appearance of the fore and after bright lights will also help me to tell the course she is pursuing, and the nearer these lights are in range the nearer she is heading for me and the more open the farther she is heading away from me.

124. About NE.

125. Starboard my helm and go astern of the sailing vessel. Or, if necessary stop and reverse; anything to go clear.

126. Heading between NW and SW. She is crossing my course.

127. She is heading somewhere between SW and SE. No, she is not crossing my course.

128. Never, unless it was absolutely necessary to avoid a collision. It is contrary to law, though the law would exonerate you if you could prove that a cross signal was the right thing to do under the circumstances. Rule 27 tells us "In obeying and construing these rules due regard shall be had to all dangers of navigation and collision and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger." You take many chances in using the cross signal, since, if you get into trouble by using it the blame rests with you, unless, of course, you could prove that it was the proper thing to do under the circumstances.

129. If the red light came into appearance as soon as the green light was shut out, the vessel is swinging on a port helm, that is, she is turning to the right. If, however, the green light shut out together with the foremast light I would know that she was swinging on a starboard helm. In the first case the foremast light would be visible all the time, while in the second case it would disappear with the green light.

130. Swinging on a port helm.

CADET ENGINEERS FOR THE REVENUE CUTTER SERVICE.

An exceptional opportunity is now offered bright young engineers to enter the government service as commissioned officers and secure a life position, with all the advantages of longevity, pay, retirement for age or physical disability incurred in the line of duty, etc., as now obtain in the United States army and navy.

The United States Revenue Cutter Service will hold an examination for the selection of candidates for appointment as cadet engineer to fill five existing vacancies in that service, beginning Oct. 1, and covering a period of four days. This examination is open to all young men between the ages of 21 and 25½ years who have had the necessary engineering training, either at some technical school or in actual work, and who produce satisfactory testimonials of experience and good character.

The successful candidates will be appointed cadet engineers, and then probably be assigned to the United States Revenue Cutter Itasca, which vessel is now on a practice cruise to the Mediterranean with three classes of cadets. During the term of service on the school-ship the cadet engineer is paid at the rate of $75 per month, and an allowance of 30 cents per diem for commuted rations.

After serving not less than six months on this vessel, if he is found to be proficient in his duties, with the proper conduct and bearing of an officer, the cadet engineer is commissioned a second assistant engineer in the regular line of promotion; his salary is increased to $1,400 per annum, and he is assigned to duty on some one of the large cruising cutters stationed at the various ports of the United States.

Any person desiring full information relative to this examination should address the honorable, the secretary of the treasury, Washington, D. C., stating his full name, age and experience, upon receipt of which request a pamphlet will be forwarded setting forth the proper manner of making application for examination, and other regulations governing the admission of candidates and the full scope of the examination.

WELIN QUADRANT DAVIT.

Editor MARINE REVIEW:—Having lately had my attention drawn to certain rumors that our company is a foreign concern and that we should be importing our davits from Europe, I would be very thankful if you would repudiate this statement by inserting in your columns the following statement: Welin Quadrant Davit was incorporated under the laws of the state of New York on Oct. 19th, 1906. The directors of the company are as follows: John McMullen, president (also president of The Atlantic, Gulf & Pacific Co. of this city); A. P. Lundin, vice president and general manager, and R. H. E. Starr, patent attorney of this city, secretary and treasurer, all being citizens of the United States and residents of New York city. So far we have had all our davits (with the exception of one set) manufactured by The Geo. V. Cresson Co., of Philadelphia, but we have recently made arrangements to have them manufactured on the Pacific coast as well. Of course it is a well known fact that Axel Welin, the inventor of these davits is a Swede, but we, having acquired the American patent rights against a certain sum of United States money, do not at all think this should reflect upon the business as being a foreign concern, and other nations have not considered this as any reason why they should not adopt a gear as useful as ours.

WELIN QUADRANT DAVIT,
A. P. Lundin,
New York, Aug. 27, Manager.

Mr. Harry Magoun, superintendent of the Marine Department of the Maryland Steel Co., has resigned to become assistant to the president of the New York Ship Building Co.

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HEATING AND DRIVING STEEL RIVETS.

A paper on "How to Heat and Drive Steel Rivets," by Mr. James Crombie, of Hamilton, Ont., was awarded first prize at the convention of the International Railway Master Boiler Makers' Association and the Master Steam Boiler Makers' Association. In riveting, Mr. Crombie said, no matter whether by hand or machine, there were several matters that must first receive attention before any rivets could be driven or a satisfactory job made. They had first the assembling of the work. The plates must be bolted together and all the rivet holes reamed out to correct size—i. e., 1-16 in. larger than the size of rivet to be used. Reamers were made with about 3 in. of tapered end and 4 in. of straight section for each different size of hole. This insured that the hole would be parallel, or the same size all the way through. After reaming, the work should be taken apart and all burrs and pieces of cuttings left between the plates by the reamer scraped off and the two surfaces made perfectly clean. The outer sides of holes should also be gone over with a broad counter-sink drill, to remove the burrs from the edge of the hole. The work should then be bolted up close and any joints warmed and closed up with hammers or squeezed in the hydraulic machine. Rivets should be of best quality of open-hearth steel, extra soft grade, ultimate strength 45,000 to 55,000 pounds, elastic limit not less than one-half of the ultimate strength.

$$\text{elongation} = \frac{1{,}400{,}000}{\text{ultimate strength}}$$

MAXIMUM PHOSPHORUS 0.06 PER CENT, maximum sulphur 0.04 per cent, cold and quench bends 180 degrees flat on itself without fracture on outside of bent portion. On being nicked and broken off the steel should be of a light gray color, showing a close-grained, silky fracture. A coarse-grained, dark-colored rivet steel should be looked on with suspicion, as the chances were that after being riveted up the rivet head would drop off. Excess of sulphur or excess of phosphorus would make the steel "short" or brittle, causing the rivets to break. He had had a lot of trouble with one consignment of rivets. After being driven the heads or points of a large percentage of these rivets would drop off, not immediately after being driven, nor when the plate edge was being calked, but 4, 5 or 10 hours after they were finished. Some of these broken rivets, 4 in. long, were backed out of the hole; they were bent 180 degrees on themselves cold without any sign of fracture. The trouble was apparently excess of phosphorus, causing segregations in spots in the steel. Where these spots were the rivet would break off easily and the material was very brittle. These rivets went into

THE SCRAP HEAP IN DOUBLE-QUICK

time. Heating the rivets did not depend so much upon the kind of fire or fuel as upon the rivet heater. Given a good, willing heater, and no matter how adverse the conditions were, he was always there with a good hot rivet, and the work went swinging along. Good work could be obtained from a coal or coke fire, either with a side or bottom blast. There was always the danger in these fires of overheating the rivets, or they might be left in the fire too long while the squad was changing or during the meal hour. The rivets would then have a heavy scale. He believed in having them out if at all possible, either by cutting off the heads and backing them out with a punch. Rivets that were sparking hot or showed signs of overheating should be discarded. If such rivets should be driven through any mistake or any heads showed signs of being burnt on examination after the job was finished, the question arose whether more injury would be caused to the plates by cutting those rivets out or hammering or drilling them out. There should be no danger of burnt rivets, although if too many rivets were put into the furnace at one time and the work was lagging behind, the rivets would quickly get scaled and waste. He had got good results from an oil furnace with any baffle brick, using pitch oil and

ALLOWING THE FLAME TO BLOW

right on to the rivets. This was principally on large sized rivets. He believed that the best results were obtained from a good oil furnace with a baffle-brick or fire wall using compressed air. They used oil rivet forges burning fuel oil, or gas oil with compressed air, and got nice, soft rivets, just a bright cherry red or white-hot if desired. This style of forge left nothing to be desired. It had a fire-wall, heated rivets quickly, and did not cost much to run. The oil and air was mixed before entering the furnace, and then passed through a small opening at the side of the furnace. Combustion then took place, the flames striking the baffle-brick or fire-wall, then passing over the top of the fire-wall and heating the chamber where the rivets were. The heat then radiated from the top down upon the rivets. Rivets that had to be driven by hand or by an air hammer required more heat than rivets for the hydraulic riveter. A cherry red would be best for a hydraulic machine, but for an air hammer or hand riveting the rivets should be a light yellow, turning to white, but not sparking. That would be about 1,500 degrees F. for hydraulic and 2,000 degrees for hand-driven rivets. There were several kinds of machines for riveting. He had seen good riveting

DONE ON AN OLD STEAM RIVETER,

each rivet receiving from two to three blows. This style of machine had gone out of date, and was seldom seen now. They had their good friend the hydraulic riveter or "Bull." This machine might be considered ideal both as to operation and effect. The water was supplied in pipes at a pressure of 1,500 lbs. or more per sq. in. In the best class of machines the pressure was delivered through different valves, so that the operator had control of the pressure at all times, reducing or increasing the pressure according to the size of rivet. The best pressure was 100 tons per sq. in. of rivet section. The water, after the rivet was squeezed, passed back to the tank again, and was used over again, so that there was very little waste of water. The full pressure was available throughout the full length of the stroke, so that the rivet was properly upset, thoroughly filling the hole from end to end, and also squeezing the plates close, holding them for several seconds while the rivet was contracting or cooling off. For heavy work, the machines should have a plate-closing device, so that the plates could be held close together before any pressure was applied to the rivet, the rivet dies being controlled by separate levers and working in the

CENTER OF THE PLATE-CLOSING DEVICE

yet separate from it. A good hydraulic crane was best suited for handling the work at the riveter. It was quick in action and very sensitive, and the hole was quickly centered with the rivet dies. All levers should be handy for the operator, the same operator controlling the levers for both crane and riveter. The work should be hung fair. A little time spent on this would be gained later on and temper saved, too. After the work had been cleaned and

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bolted up it was squeezed up and all the bolts tightened. The boiler should then be tacked at each quarter, then at each eighth, and afterwards at every third or fourth hole. The remaining rivets were then driven, going right along around the boiler, allowing the full pressure of the machine to remain for a few seoonds on each rivet as it was driven. At the longitudinal seam or butt-joint the end should be tacked first, to prevent springing, then at the center, after which the rivets must be driven in succession. The operator should be given to understand that it was not the number of holes he could fill up, but the quality of the work on the testing floor that counted. The danger to be looked for was the crushing or scalloping of the plate in front of the rivet,

THROUGH EXCESSIVE PRESSURE OR

through too much being planed off the plate edge. Also the point might fail by not being properly proportioned, by the plate breaking along the line of rivets by the shearing out of the rivets or by the shearing of the plate in front of the rivets, and if the work was not hanging fair the rivets might be driven off-side, thus necessitating cutting out. All rivets should be put into the holes from the outside, as it was much quicker and required a man less on the job. A man inside the boiler was apt to get hurt, too. There was also the pneumatic lever type of machine, the hydro-pneumatic type; the pneumatic toggle-joint machine giving a full pressure only at end of stroke, and the portable hydraulic type similar to the "Bull." The latter was handy for riveting around the ends of boilers or furnace mouths, or around the flanges of flues in Lancashire or Cornish boilers. The water, after it was discharged from the machine, did not return to the tank as in the fixed riveter, but was conducted through a rubber hose to the nearest sewer. This type was wasteful as regarded water. He pinned his faith on the hydraulic riveters, as first-class work could be obtained from them. The rivets did not require such an intense heat, therefore there was

NO RISK OF BURNT RIVETS.

and there need be no guess work about the pressure applied to each rivet. He used high-speed air hardening steel for rivet dies on the "Bull." The initial cost was high, but they were all right. He had driven 180,000 rivets with four pairs of dies made from this steel, and they had not been to the tool room since they started to use them. They were still sharp on the edge, and were only beginning to show slight signs of wear. The most that could be got from a pair of ordinary cast steel rivet dies was about 4,000 rivets, while these, he believed, would average 50,000 each. Another good riveter was the air hammer or "Gun," working with compressed air at a pressure of 80 to 100 lbs. per sq. in. With this machine a careless riveter, or one wanting to make a show, might drive a short rivet, too short to properly fill the hole, merely blinding the work by allowing his hammer handle to describe a large circle, thereby spreading the rivet instead of allowing it to upset into the hole. If there was enough stock in the rivet and the rivet was driven fair into the hole these hammers would give a good tight rivet that would not require calking. With the air hammer it was necessary to hammer up the plate in front of the riveter and to have the work all thoroughly closed up, so there was no squeeze

AS IN THE HYDRAULIC MACHINE.

In work to be riveted by hand it was better to have all holes countersunk. The countersink must be narrow and deep, from 1-16 to ⅛ in. of the bottom of the hole in the first plate, then if corrosion or wasting occurred the rivet and plate would both wear equally and the strength of the rivet would not be impaired. Where a shallow, broad countersink was used there was more chance of the rivet breaking off than where a narrow deep one was used. The rivets might be snapped by hand, but this practice had gone out, as the rivets were not so reliable as when countersunk. The best practice was to finish on the third rivet, that was, they had the squad all ready to start with hammers, the hole was hammered close and the first rivet was put in and hammered down but not finished, the second hole was plied close, the rivet hammered down as before, the same with the third and fourth. The fifth rivet was then put in, the sixth hole plied close, and the squad went back to the third rivet, giving it a few heavy blows, then finishing it off with their riveting hammers. Thus they worked right along,

ALWAYS FINISHING ON THE THIRD RIVET

back. It was hard to give any hard and fast rule regarding holding up the rivets, as there were so many different classes of boiler work and so many different tools to be used around a boiler in holding up. They had their dolly bars and waterspace hammers, and also long-handled hammers, supported on a hook. Where possible it was best to use the compressed air holder-on. In all these things they must be guided by circumstances, always endeavoring to get the head well up or the rivet would not be tight.

TEMERAIRE LAUNCHED.

The battleship Temeraire, the third of the Dreadnought class, was successfully launched last week.

The new battleship will cost more than $5,000,000, exclusive of her armament, and will be bigger than the Dreadnought as regards tonnage, though of the same dimensions. Her displacement will be 18,600 tons, 700 more than the Dreadnough, while her draught will be half a foot more. Among her other improvements will be two additional guns to fire astern, a change from 27 twelve-pounders to the same number of four-inch guns and twenty-five pounders, and a simplification of the handling of the propelling machinery.

She is the fifth Temeraire to be possessed by the British Navy. The name appeared in the service attached to a warship captured from the French in 1694. Her successor was obtained in the same manner sixty-five years later. Then came the "fighting Temeraire," which took part in the battle of Trafalgar and was immortalized by Turner. The fourth Temeraire was an ironclad built in 1876, and the first British vessel to have guns mounted according to the disappearing principle.

A RECORD CATCH FOR A WHALER.

A cable was received at New Bedford, Mass., in the beginning of June, announcing the arrival at Little Fish Bay, on the west coast of Africa, of the whaler Sullivan, which left New Bedford exactly a year before, and has made the largest catch on record for the period. First she made port and landed two thousand two hundred and forty barrels of sperm-oil. Now she has returned with another thousand barrels, making a total of three thousand two hundred and forty barrels of sperm-oil for twelve months' whaling. This is an average of one hundred and thirty-five barrels a month, and one hundred barrels a month was always considered a high prize.—*The Ocean.*

The auxiliary cruiser Panther, which is to be converted into a repair ship to accompany the Atlantic fleet to the Pacific, arrived at the New York navy yard last Saturday afternoon. The work of transforming the Panther into a floating machine shop will begin at once.

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QUESTIONS AND ANSWERS.

Question.—Will you kindly explain how to determine the number of persons a life boat will carry? Supposing a boat is 20 ft. 4 in. long by 5 ft. 8 in. beam and 2 ft. 3 in. deep, how many people will she be allowed to carry?

Answer.—Rule. Multiply the outside length by the outside breadth (amidships), and this again by the inside depth, and then multiply by 0.6 and divide by 10 for lake, bay, ocean and sound steamers, but for river boats divide by 8.

This is cubic measure, and is figured on the same principle of finding the number of cubic feet in a cord of wood, as 8 ft. long multiplied by 4 ft. wide multiplied by 4 ft. high, equals 128 cu. ft., or the number of cubic feet in a cord. This example makes a box-like shape with square corners, that is, the length of the box is equal to the length of the boat in question, the width of the box is the beam of the boat and the depth of the box the depth of the boat, so that it becomes necessary to make a reduction for what the boat narrows at the stem and stern and the round of the bottom. This is the reason for multipling by 0.6, which reduces the cubical contents of the boat to what it actually is. We divide by 10 because each person is allowed by law a space of 10 cu. ft., and the reason we divide by 8 for river boats is that they are allowed to carry more than life boats on the lakes and ocean, because there is no waves and sea to contend with.

Here is the law on the subject: The capacity of all life boats shall be determined by the following rule: Measure the length and breadth outside of the planking or plating, and the depth inside of the place of minimum (least depth). The product of these dimensions multiplied by 0.6 resulting in the nearest whole number shall be deemed the capacity in cubic feet.

To determine the number of passengers a boat is to carry, divide the result by 10 for ocean, lake, bay and sound steamers; and for river steamers divide the result by 8. Provided, however, that such boats shall in all cases have sufficient room, freeboard, and stability to safely carry such number of passengers, which fact must be determined by actual experiment in the water at the first inspection of said boats after the passage of this rule.

A boat 20 ft. in length, 5 ft. in breadth and 3 in. in depth, will carry as follows:

$20 \times 5 \times 3 \times 0.6 = 180 \div 10 = 18$ persons.

For river steamers, same boat would carry 23 persons.

Note.—Multiplying by 0.6 (6-10) is the same thing as allowing 40 per cent off for round of bottom and the narrowing at stem and stern. If we multiplied by 0.4 in the first place the operation would be longer; thus: 75 cu. ft. $\times$ 4 = 30 cu. ft. 75 — 30 = 45. But by multiplying by 0.6 in the first place gives the result at once, thus $75 \times 0.6 = 45$.

According to the dimensions of the boat given by you would be allowed 15.5 persons, either 15 or 16 persons. The example worked out in full would stand thus:

20 ft. 4 in. $\times$ 5 ft. 8 in. $\times$ 2 ft. 3 in. would be 20 4-12 ft. $\times$ 5 8-12 ft. $\times$ 2 3-12 ft., which reduced would be 20 1-3 ft. $\times$ 5 2-3 ft. $\times$ 2¼ ft. In improper fractions this would be

$$\frac{61}{3} \times \frac{17}{3} \times \frac{9}{4} = \frac{3111}{12}$$

427
61
1037
3

12)3111.0 (258.4
24 .6
71 10)155.04
60
111 15.5 persons.
96
50
48

Example: How many persons will a life boat carry of the following dimensions: 15 ft. 6 in. long by 6 ft. beam and 2 ft. depth of hold.

15.5 10)111.60(11.
6 10
93.0 11
2 10
186.0 16
.6 10
111.60 60

This boat will carry 11.16 persons.

Note.—Whenever the decimal is less than one-half discard it altogether, but when one half or more, call it a whole one, as in the above example.

Franklin P. Snyder, a well known marine engineer, died at Muskegon, Mich., last week at the age of fifty-three years.

PROPOSED NAVAL BILL.

The naval appropriation bill which will be presented to the next Congress will recommend that two and perhaps four more battleships of at least 20,000 and possibly 25,000 tons displacement be authorized. Seven members of the house committee on naval affairs made an official visit to the New York navy yard and the information about this recommendation came from some of them after the visit.

The vessels to be authorized may be sister ships of the 20,000-ton Delaware. The contract for that vessel was let recently, or, as one of the members of the committee put it, "Congress may go further and authorize the construction of battleships of even 25,000 tons."

Those who visited the navy yard were George E. Foss of Illinois, Ernest W. Roberts of Massachusetts, George A. Loud of Michigan, Arthur L. Bates of Pennsylvania, George L. Lilley of Connecticut, W. Aubrey Thomas of Ohio, and Albert F. Dawson of Iowa.

The visitors were taken through the various buildings in the morning, and in the afternoon they met Admiral Goodrich, the commandant, and the heads of departments. Admiral Goodrich and Congressman Foss did most of the talking, which related almost entirely to needed improvements in the New York navy yard.

After the conference Mr. Foss said that the naval officers had asked nothing unreasonable. One of the important matters discussed was the proposition to change the river entrance to the yard so as to make it possible to berth several more battleships in the yard than is now possible.

"New York is to be congratulated," Mr. Foss said after the conference, "on the fact that such a man as Admiral Goodrich is at the head of the navy yard. He is one of the great men in the navy."

Mr. Foss was averse to giving an opinion as to what Congress would do in the way of battleships.

"I believe that four battleships of the most powerful type will be recommended, and I feel certain that at least two will be authorized," said Congressman Bates, "and they will carry at least ten guns of the twelve-inch type."

The New York Ship Building Co., Camden, N. J., is building eight steel steam lighthouse tenders for the lighthouse board. The company was the lowest bidder, offering to construct the eight at $164,000 each, or, if equipped with Babcock & Wilcox boilers at $168,000 each.

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AT HEAD OF THE LAKES.

Duluth, Aug. 24.—The general situation at the head of the lakes is improved this week both in mining and shipping. The striking miners continue inactive with the exception of such efforts as they have made to dissuade the labor imported by the Steel Corporation from working in the mines. These efforts have accomplished but little however and practically all of the men brought in are now working in the various mines. While the imported labor may not have a present efficiency or skill being composed of surface laborers for the most part, that is all that can be desired, still the bringing in these additional workingmen cannot fail ultimately to be of considerable advantage because the process of training these men will not be different from what is continually going on at the mines where unskilled men gradually become miners. Full crews of men will hardly be obtained however this season.

The underground mines of other companies than the Oliver Iron Mining Co. are still shorthanded also and the output correspondingly limited. A number of the old men are coming back, men who left the range but there are still some as well who are quitting. The amount of ore shipped during the week ending Aug. 21 increased 85,499 tons over the tonnage of the preceding week and a total of 1,111,296 tons was brought down from the range. The Missabe road is expecting to ship 2,000,000 tons in August which is practically normal capacity, but the number of tons handled is not the only consideration involved in making a satisfactory situation and though the boats are moving much better this week than last and are getting better dispatch it is admitted that the ore is not coming down just right yet.

The figures in detail for the shipments of the week are as follows: Duluth in 1907, 485,964 tons; in 1906, 389,424 tons. Two Harbors in 1907, 139,779 tons; in 1906, 264,634 tons and Superior 305,553 tons in 1907 and 194,918 tons in 1906. A gain of 262,320 tons was made therefor over the corresponding week a year ago. This is at the rate of about 1,100,000 tons a month which increase if continued until the end of the season will mean a gain of 3,500,000 tons.

At Ashland the rush which existed during the strike has eased up materially and owing to the fact that stockpiles are pretty well cleaned up the shipments will continue to decrease. At the northwestern dock where it was not expected that as much ore would be shipped this year as last the movement is about even. The Wisconsin Central has shipped about 80,000 tons more than in 1906 and will wind up the season with approximately that increase.

The amount of grain shipped from Duluth is very light at present and the rate has gone up ½ cent, being 13¼ cents to Buffalo on wheat.

Coal cargoes continue plentiful and a large amount is being received at this port. The boats of the Pittsburg Steamship Co. line which rarely carry coal for other than the steel corporation's use have been carrying outside coal regularly for a couple of weeks.

In one afternoon last week two tugs were put out of commission. The E. T. Carrington coming from Ashland to Duluth sprang a leak and sank. Her crew were rescued by the steamer Frederick B. Wells, which fortunately was near by. The Carrington was built at Saginaw in 1876. The other, the supply tug Edna, was crushed between the dock and the steamer Alva of the Duluth and Chicago Transit Co. in Northern Pacific Slip No. 6. The tug was badly damaged and had to be beached at the end of the slip.

The new freighter Ward Ames, sistership of the Augustus B. Wolvin and the James C. Wallace and owned by the Acme Steamship Co., was successfully launched at Superior, Saturday afternoon at 3 p. m. A good deal of interest attached to the boat locally because it was named after a Duluth firm, built for a head of the lakes ship yard. The launching, therefore, became an occasion of some social importance and following slide into the water a dinner at which some 250 invited guests sat down, was given at the ship yard.

The boat was christened by three-year-old Florence Draper, granddaughter of Ward Ames. Beside the sponsor and her parents, Mr. and Mrs. Rufus Draper, the members of the launching party were: Mr. and Mrs. Ward Ames, Ward Ames Jr., Mr. and Mrs. A. M. Miller, Mr. and Mrs. George Spencer, Mr. and Mrs. D. T. Helen, Mrs. and Mrs. Louis Williams and Mr. and Mrs. A. B. Wolvin. The Ward Ames is 552 ft. over all, 532 ft. keel, 56 ft. beam and 30 ft. deep and will be ready for sailing in about two weeks.

Capt. Walter Singer, a well known vessel owner of Duluth, died at Houghton, Mich., on Saturday afternoon last, at the age of forty-nine years.

INTERESTING COMPARISON

As a dirt-digging proposition the Panama canal is undoubtedly the excavating work most in the public mind. At the same time, those familiar with the opening up of the ore deposits on the Mesabi range are prepared to claim that better records in steam shovel work are made in Minnesota than any place else in the world. Some figures from both operations are available and afford interesting comparisons.

It is to be remembered, of course, that the conditions under which the work was done in each locality are not identical. On the Panama, the "earth" is probably as good as the best stripping in Minnesota and the "rock" somewhat more difficult of handling than the boulders of the northern glacial drift. With the possible exception of labor, other circumstances should be very nearly equivalent.

The following report of the work at Panama shows an average daily performance for a shovel of 412 cubic yards of rock and 354 cubic yards of earth, a total of 766 yards. This is for an 8-hour day and would be on the basis of a 10-hour day 957.5 cubic yards a day.

The report is as follows:

1907.	Rock.	Earth.	Total	Average daily No. steam shovels.
March ...	380,300	434,970	815,270	43 22-25
April	497,183	382,344	879,527	44 3-26
May	391,609	298,756	690,365	31 18-26

The average performance for a shovel of the Panama type on the Mesabi range for a 10-hour day is 900 cubic yards. In one month, however, three shovels have been known to dig 190,000 yards or at the rate of 1,218 yards per shovel for 10 hours. During the season and in one month five shovels, three of them Bucyrus and two Marion, made the following record:

Hours Worked.		Yards Removed.	
Month.	Season.	Month.	Season.
500	1,570	64,685	183,940
380	2,630	64,070	310,331
500	2,360	46,937	226,477
490	3,000	47,116	281,788
486	486	53,301	53,301

From this it will be seen that five shovels handled in one month 276,109 cubic yards, as compared with 879,527 cubic yards handled by 44 shovels on the Panama. Correcting for the 10-hour day we have 220,888 yards, or practically one-fourth of the amount removed on the Isthmus. As the above season record of these shovels appears to be in about the same ratio as their monthly performance it would seem that 900 yards is a very conservative estimate of 10 hours' work for a shovel on the Mesabi range.

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PUBLICITY; OR, HOW I BOUGHT A 5-H. P. MOTOR.

BY BEN FRANK .

I was in want of a 5-H. P. motor for driving a small machine, and sent the following inquiry to a large Americanized motor manufacturing company: "Kindly quote me, by return of post if possible, for a 5-H. P. shunt-wound motor, to run at about 1,200 r. p. m. on a 200-volt continuous current circuit, complete with sliding rails and pulley."

In reply to the above I received the following: "We are much obliged by receipt of your valued inquiry for motors, and enclose you herewith our Motor Enquiry Form, and on receipt of this duly filled in we shall be able to quote you by return of post."

This form was one of the new publicity documents, and contained about 125 columns or spaces to be filled in with various particulars, and covered every conceivable detail that might apply to a motor of any description, continuous or polyphase. I thought it best to fill this form in, although I could give no more information than was contained in my original inquiry.

By return of post I received the following:

"We are duly in receipt of yours of yesterday enclosing our Motor Enquiry Form filled in, which we have handed over to our Estimating Department, who will quote you in due course. As you are in the market for motors, we enclose you herewith our pamphlet on Motor Driving, which will show the absolutely unique position we hold in the motor world. There is no branch of this extensive industry which we have not touched, and the services of our vast technical staff are fully and freely at your entire disposal. Awaiting your further inquiries, we are, etc."

After waiting for two days, I sent a postcard to remind the firm that I had not received the quotation yet, and received the following reply,

"Your postcard came duly to hand, and we regret that, owing to extreme pressure of business in our Estimating Department, your inquiry has not yet reached its turn. We receive thousands of inquiries daily for motors, and these must, of course, be taken seriatim. We are now within a few hundred of yours, and have every hope of reaching it today. We take the liberty of enclosing herewith our pamphlet on Electric Ventilation. We know that 99 per cent or more of the offices in London would be equipped with our electric fans if we had the chance of personally discussing the matter with the tenants, and if, after perusing the enclosed, you would like a call from us, we will send round one of our salesmen who will go fully into the matter with you, and positively convince you that it is physically impossible for you to successfully carry on your business without one of our electric fans on your desk."

Then, after a day or two, I sent another postcard, saying, "Do please let me have that quotation by return." But instead of the estimate I got the following:

"We regret that our quotation has not yet reached you, but the whole of our engineering staff have been working night and day on it, and hope to have it completed by midnight tonight, and it shall be sent round by special messenger in the morning. We find that we have not yet heard from you on the subject of electric fans. We have tried our best to make the advantages clear to you, and to show you how much more life would be worth living during the hot weather, if your office could be kept cool and fresh by electric fans. If we had the descriptive powers of Sir Walter Scott and the force of Sandow, we might succeed in making the thing stronger, but being simply salesmen with nothing but our knowledge of the real beauty of fans to tired, overheated humanity, we can only repeat that it is our firm conviction that you cannot possibly be happy until you get them."

By the same post I received also an appeal from the supply company, who had evidently been told by the motor company that they had had inquiries from me for motors, and that in all probability I had a private plant. The circular was to the following effect:

"Why make your door a dumpheap? Customers will not push into your office past dusty, greasy stokers; and coal and ash carts on your curbstones do not look well. Let us do the shovelling. Let us make the noise, grease, smells and dirt, miles away from your office. That is our business, yours is to keep clean, cool and quiet. We are experts in the shovelling business. Our men like it. It is second nature to them. On receipt of the enclosed card, one of our salesmen will be round by motor-car in five minutes."

Another postcard from me to the motor company, saying that unless I got the quotation by return I should go elsewhere for my motor, brought forth the following reply:

"We know how tired you must be waiting for that quotation, but we can assure you that when you get it you will be delighted. No motors are like our motors. Every horsepower given by our motors is worth at least 5 H. P. given by anyone else's. What about arc lamps? Surely you want some arc lamps, and we enclose herewith our bulletin which tells you all about them. Electric light is one of the great discoveries that go far towards making this twentieth century life of ours better worth living—fuller of refinement, comfort and culture."

Just as I had finished reading this, my clerk brought in a traveller's card. He represented a motor maker. I don't usually see travellers, but just as a drowning man clutches at a straw, so I grasped the chance of seeing this man.

"Do you make motors?" I asked. "Well, then, can you give me a quotation for a 5-H. P. shunt-wound motor, 200 volts, 1,200 r. p. m.?"

"Oh, yes," he said, "I can give you a quotation for that now." And in about two minutes he had figured it out from his list, and taken off the discount.

"Now, then, how soon can you deliver?"

The traveller turned up his stock list, and said, "We have one in stock—could send it off today if I wire the works."

"You are not an engineer, I suppose, just a traveler, and know nothing about the technical details of these motors. Don't know a motor from a rheostat, I suppose?"

"Oh, yes," he said, smiling, "I am an engineer, and can tell you anything you like about the motor."

The result was that this representative took the order with him, telegraphed for the motor, and it was in my place and running within two days.

I am still receiving weird pamphlets and bulletins from the motor company, and I suppose their engineering staff are still working night and day on that quotation, for I have never received it.—*The Electrical Review*, London.

Owing to the derangement of machinery on the passenger steamer Peerless, seventy passengers had to be transferred to the steamer Georgia while about six miles off the port of Chicago. The pounding from the engine room was so loud that many of the passengers were badly frightened.

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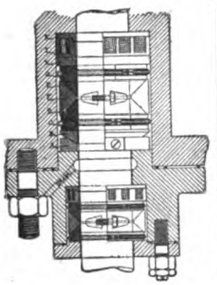

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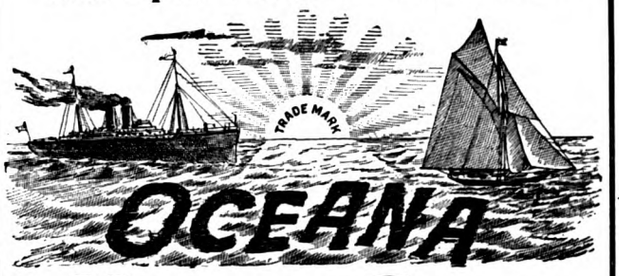

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INDEX OF ADVERTISERS

The star (*) indicates that the advertisement appears alternate weeks. For addresses see advertisements on page noted.
The dagger (†) indicates that advertisement appears once a month.

†Akers Steering Co..... —
Almy Water Tube Boiler Co.. 37
American Blower Co..... 52
American Injector Co..... 11
American Line 47
American Sawdolet Co..... 38
American Ship Building Co... 4
American Ship Windlass Co.. 2
Armstrong Cork Co..... 52
*Armstrong Manufacturing Co. —
†Ashton Valve Co..... —
Atlantic Works 47
†Atlantic Works, Inc..... —

Babcock & Penton..... 49
Baker, Howard H., & Co.... 52
Belcher, Fred P..... 48
Boland, J. J..... 48
*Boston & Lockport Block Co. ..... —
†Boucher Mfg. Co., The H. E. —
Bowers, L. M., & Co..... 51
Breymann, G. H., & Bros.... 39
Briggs, Marvin 38
Brown & Co..... 48
†Brown Hoisting Machinery Co. ..... —
Buffalo Dredging Co..... 39
Buffalo Dry Dock Co..... 5
†Buffalo Ship Chandlery & Supply Co. ..... —
Bunker, E. A..... 52

Chase Machine Co..... 36
Chicago Ship Building Co... 4
Cleveland & Buffalo Transit Co. 47
Cleveland City Forge & Iron Co. 51
*Collingwood Shipbuilding Co. —
†Columbian Rope Co..... —
Continental Iron Works..... 2
Cory, Chas., & Son..... 50
Cramp, Wm., & Sons S. & E. B. Co..... 8
†Crescent Machine Co..... —
Curr, Robert 49

Dake Engine Co..... 3
Dearborn Drug & Chemical Wks. 3
Delany, P., & Co..... 37
Delaware River Iron S. B. & E. Works 51
Detroit Ship Building Co.... 4
Dixon, Joseph, Crucible Co.. 43
Donnelly Salvage & Wrecking Co. 43
Douglas, G. L., Jr..... 48
Drein, Thos., & Son..... 43
Dunbar & Sullivan Dredging Co. 39

Elphicke, C. W., & Co..... 48
*Emerson Shoe Co...—..... —
†Empire Shipbuilding Co..... —

Falls Hollow Staybolt Co..... 41
Fix's, S., Sons..... 50
Fletcher, W. & A., Co..... 47
Fogg, M. W..... 50
Fore River Ship Building Co. 47
Furstenau, M. C..... 49

General Electric Co..... 52
Gilchrist, Albert J..... 48
†Goldschmidt Thermit Co..... —
Goulder, Holding & Masten.. 49
Great Lakes Dredge & Dock Co. 39
Great Lakes Engineering Wks 12
Great Lakes Register..... 49
*Great Lakes Towing Co..... —
†Griscom-Spencer Co. ..... —

Hall, John B..... 48
Hanna, M. A., & Co..... 41
†Hardy & Dischinger Co..... —
Hawgood, W. A., & Co..... 48
Helm, D. T., & Co..... 48
Holmes, Samuel 48
Hoyt, Dustin & Kelley..... 48
Hunt, Robert W., & Co..... 49
Hutchinson & Co..... 48
Hyde Windlass Co..... 52

†Ideal Pump Governor Co... —
International Mercantile Marine Co. 47

Jenkins Bros. 52
Jenkins, Russell & Eichelberger 48
Johnson Bros. 37
Kahnweiler's Sons, David.... 51
Katzenstein, L., & Co..... 35

Kidd, Joseph 49
Kingsford Foundry & Machine Works 37
Kremer, C. E..... 48

*Le Mois Scientifique et Industrial 43
Levine & Co..... 41
Lockwood Mfg. Co..... 50
Lorain Coal & Dock Co..... 49
Lundin, A. P..... 52
Lunkenheimer Co. 11

McCarthy, T. R..... 48
McCurdy, Geo. L..... 35
McKinnon Iron Works..... 51
MacDonald, Ray G..... 48
Mallory Line 47
*Marine Iron Co., Bay City, Mich. 11
†Marine Iron Works..... —
*Marine Mfg. & Supply Co. 12
Marshall, Alexander 48
Martin-Barriss Co. 43
Maryland Steel Co..... 10
Maytham, Frank 48
Mehl, Edward 48
Milwaukee Dry Dock Co..... 5
Mitchell & Co..... 48
Morse, A. J., & Son..... 51

Nacey & Hynd..... 49
†New Bedford Boiler & Machine Co. ..... —
Newport News Ship Building & Dry Dock Co..... 6
New York & Cuba Mail S. S. Co. 47
New York Shipbuilding Co... 7
†Nicholson Ship Log Co..... —
Northern Dredge Co..... 39
Northwestern Steam Boiler & Mfg. Co. 37

O'Connor, J. J..... 48
†Oster Mfg. Co..... —
Otis Steel Co..... 9

Parker Bros. Co..... 48
Penberthy Injector Co..... 11
Pickands, Mather & Co..... 41
Pittsburg Coal Co..... 9
Prindiville & Company..... 49

Quintard Iron Works Co..... 50

Red Star Line..... 47
Republic Belting & Supply Co. 35
Richardson, W. C..... 48
*Ritchie, E. S., & Sons..... —
Roberts Safety Water-Tube Boiler Co. 11
Roelker, H. B..... 50
†Rogers Steam Oil Separator Co ..... —
Root, W. O..... 49
Ross Valve Co..... 50

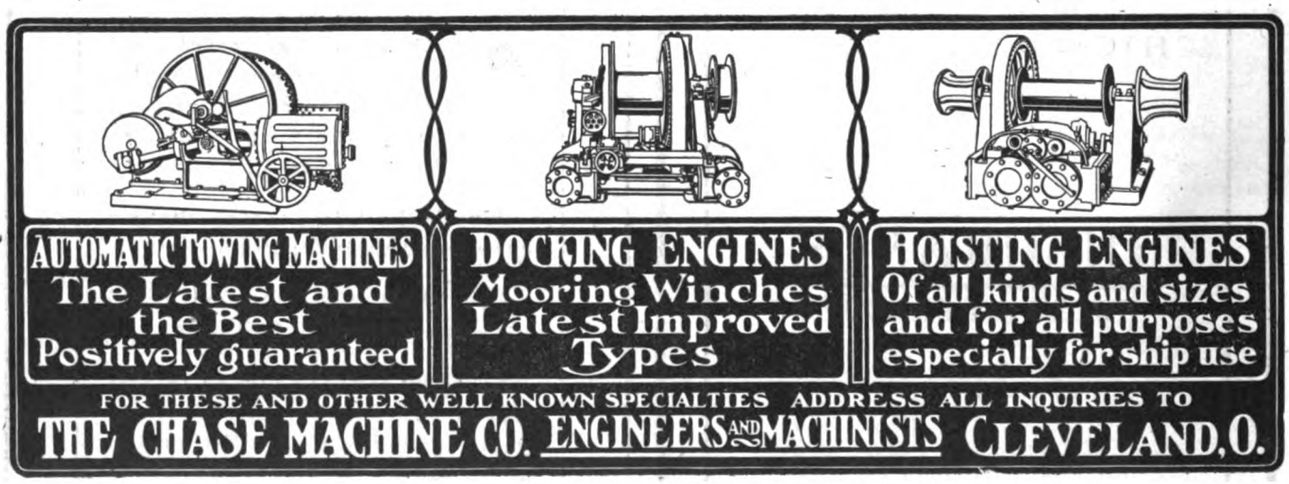
Safety Car Heating & Lighting Co. 5
Scherzer Rolling Lift Bridge Co. 43
Schrader's A., Son, Inc..... 50
†Scoville Check Valve Co... —
†Seneca Chain Co..... —
Shaw, Warren, Cady & Oakes 48
*Shelby Steel Tube Co..... 37
Sheriffs Mfg. Co..... 43
Shipping World Year Book... 50
Siggers & Siggers..... 38
Smith Coal & Dock Co., Stanley B. 3
Smooth-On Mfg. Co..... 51
†Spence Mfg. Co..... —
Spencer, H. R..... 48
Standard Varnish Works..... 35
Starke, C. H., Dredge & Dock Co. 39
†Steel Mill Packing Co..... —
Stratford, Geo., Oakum Co... 43
Submarine Signal Company.. 9
Sullivan, D., & Co..... 48
Sullivan, M. 39
†Superior Iron Works..... —
Superior Ship Building Co... 4

Taylor Water-Tube Boiler Co. 37
Tietjen & Lang Dry Dock Co. 50
*Toledo Fuel Co..... —
Toledo Ship Building Co.... 5
†Toledo White Lead Co..... —
Trout, H. G..... 43
Truscott Boat Mfg. Co..... 2

Upson-Walton Co. 35
†United States Graphite Co.. —

Vance & Joys Co..... 48

Walker, Thomas, & Son..... 3
Ward Line 47
Warner, Dorr E..... 48
Wilby, Carlton 49
*Watson-Stillman Co. ..... —
†Wheeler Condenser & Engineering Co. ..... —
Willcox, Peck & Hughes..... 38
†Williams Gauge Co..... —
Williams, D. T., Valve Co... 2
Wood, W. J..... 49
†Woodhouse Chain Works.... —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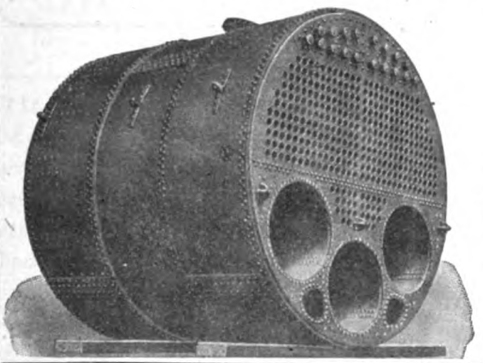

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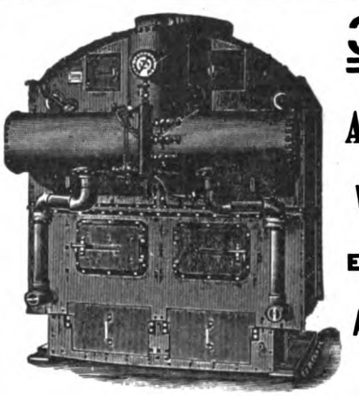

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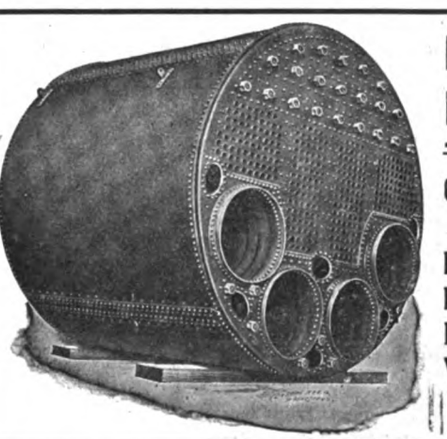

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PROPOSALS.

PROPOSALS FOR CONSTRUCTING breakwater. U. S. Engineer Office, 813 Prospect Ave. S. E., Cleveland, Ohio, August 10, 1907. Sealed proposals for extension of west breakwater at Fairport Harbor, Ohio, will be received at this office until 2 P. M. Standard Time, September 10, 1907, and then publicly opened. Specifications, blank forms and all available information will be furnished on application to this office. C. McD. Townsend, Lieut. Col., Corps of Engineers, U. S. A.

PROPOSALS FOR CONSTRUCTING breakwater. U. S. Engineer Office, 813 Prospect Ave. S. E., Cleveland, Ohio, August 10, 1907. Sealed proposals for extension of the east breakwater at Cleveland Harbor, Ohio, will be received at this office until 2 P. M. Standard Time, September 10, 1907, and then publicly opened. Specifications, blank forms and all available information will be furnished on application to this office. C. McD. Townsend, Lieut. Col., Corps of Engineers, U. S. A.

U. S. Engineer Office, Milwaukee, Wis., Aug. 2, 1907. Sealed proposals for removing old pier, building pile pier, dredging, etc., at Two Rivers Harbor, Wis., will be received here until 2 P. M. September 3, 1907, and then publicly opened. Information furnished on application. W. V. Judson, Major, Engrs.

U. S. Engineer Office, Jones Building, Detroit, Mich., Aug. 26, 1907. Sealed proposals for dredging Section 1, Plan B, Detroit River, will be received here until 3 P. M. October 8, 1907, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col., Engrs.

U. S. Engineer Office, Jones Bldg., Detroit, Mich., August 26, 1907. Sealed proposals for rock and earth excavation, Section 2, Plan B, Detroit River, will be received here until 3 P. M., October 7, 1907, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col., Engrs.

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